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ABSTRACT

A description of the perceptual/psychomotor ability requirements for performing the tasks of various Air Force career fields was sought. An analysis of the literature relating to taxonomies, measurement considerations and job analyses yielded a taxonomy containing thirteen perceptual/psychomotor classes along with techniques for collecting the required data. The methods were first tested in two career fields, revised, and then were applied in a large scale data acquisition effort which included thirty-five Air Force career fields. This work included over eight hundred job incumbents at ten Air Force bases. High and low perceptual/psychomotor ability requirements were determined for each of the thirty-five Air Force career fields. Indexes of profile similarity indicated that the perceptual/psychomotor requirements for most career fields are, in part, unique. A factor analysis of the data indicated that the perceptual/psychomotor ability taxonomy can be described by three factors: visual, auditory, and manual factors. The conclusions of the study point to (1) the adequacy of the taxonomy for describing the perceptual psychomotor requirements of Air Force career fields, (2) the utility of the technique employed for future investigations of this sort, (3) the partially unique perceptual/psychomotor requirements for various Air Force career fields, and (4) the adequacy of the present effort as a basis for perceptual/psychomotor test development for use as an aid in career selection and classification. (Author/KC)

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AIR FORCE HUMAN RESOURCES LABORATORY

PERCEPTUAL/PSYCHOMOTOR REQUIREMENTS BASIC TO PERFORMANCE IN 35 AIR FORCE SPECIALTIES

By

Arthur I. Siegel
Philip J. Federman
Eugene H. Welsand
Applied Psychological Services, Inc.
Science Center
Wayne, Pennsylvania 19087

MANPOWER AND PERSONNEL DIVISION
Brooks Air Force Base, Texas 78235

December 1980

Final Report

U.S. DEPARTMENT OF HEALTH,
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This technical report has been reviewed and is approved for publication.

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Manpower and Personnel Division

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A description of the perceptual/psychomotor ability requirements for performing the tasks of various Air Force career fields was sought. To this end, an analysis of the literature relating to taxonomies, measurement considerations, and job analyses was completed to establish appropriate methodologies. This yielded a taxonomy containing 13 perceptual/psychomotor classes along with techniques for collecting the required data. The methods were first tested in two career fields and then, after appropriate revision, were applied in a large scale data acquisition effort which included 35 Air Force career fields. This work included over 800 job incumbents at 10 Air Force bases. High and low perceptual/psychomotor ability requirements were determined for each of 35 Air Force career fields. Indices of profile similarity indicated that the perceptual/psychomotor requirements for most career

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fields are, in part, unique. A factor analysis of the data indicated that the perceptual/psychomotor ability taxonomy can be described by three factors: visual, auditory, and manual factors.

The conclusions of the study point to: (a) the adequacy of the taxonomy for describing the perceptual/psychomotor requirements of Air Force career fields, (b) the utility of the technique employed for future investigations of this sort, (c) the partially unique perceptual/psychomotor requirements for various Air Force career fields, and (d) the adequacy of the present effort as a basis for perceptual/psychomotor test development for use as an aid in career selection and classification.

PREFACE

This research was conducted under Work Unit ILIR0042 (Lab Director's Fund), Development of Methodologies for Assessing Perceptual/Psychomotor Ability Requirements in Air Force Specialties. Appreciation is expressed to Mrs. Mary Spencer (AFHRL/MP) for her assistance in assembling the task inventory data and to Mr. Henry Clark (AFHRL/TS) for his outstanding efforts during the sample identification phases.

TABLE OF CONTENTS

Page

I. INTRODUCTION 1

II. TAXONOMY DEVELOPMENT 3

Perceptual/Psychomotor Taxonomies 4

Major Perceptual Motor Ability Taxonomies Prior to 1968 4

Berliner's Taxonomy 4
Fleishman's Taxonomy 6

Major Perceptual Motor Ability Taxonomies After 1968 . . 8

Harrow's Taxonomy 8
Hunter's Taxonomy 11
Rarick and Dobbins' Taxonomy 15
Applied Psychological Services' Taxonomy 15
Miscellaneous: General Test Batteries 17
General Aptitude Test Battery (GATB) 17
Differential Aptitude Tests (DAT) 18
Flanagan Aptitude Classifications Tests (FACT) 18
Employee Aptitude Survey (EAS) 19
Guilford-Zimmerman Aptitude Survey 20
Suggested Taxonomy for Determining the Perceptual/Psychomotor Ability Requirements in Selected Air Force Specialties 20

Measurement Considerations 30

Theoretic Issues 30
Scaling Classes 31
Representative Scaling Approaches 31
Types of Continua 32
Relating One Scale to Another 33
Invariance When Scaling Job Requirements 36
Implications 37

III. METHOD DEVELOPMENT AND PRETEST 39

Methods of Job Analysis 39

TABLE OF CONTENTS (cont.)

Page

Direct Observation by Analysis. 39
Interview Methods 40
Questionnaires and Task Lists 41
Daily Diary 42
Critical Incident. 42
Comparison of Various Approaches 43

Task List Method 44

Discussion of Task List Method 44

Pretest Sample and Task Sample 46

Pretest Sample 46
Task Sample 47

Development of Forms 48

Perceptual/Psychomotor Abilities 48
Perceptual/Psychomotor Ability Requirements Questionnaires. 55
Pretest Administration 56
Administrator's Training. 56

Administrator Instructions 57

Personal Interview. 59

Interviewer Instructions 60

Interviewer Instructions. 60

Interview Sample 61

Results--Quantitative 61

Discrimination--Taxonomic Classes--Fire Protection Career Field. 62
Discrimination--Taxonomic Classes--Munitions Maintenance Career Field. 65

TABLE OF CONTENTS (cont.)

Page

Discrimination--Tasks--Fire Protection 68
Discrimination--Tasks--Munitions Maintenance . . . 68
Discussion and Summary of Discrimination Analyses 71
Amount and Performance Quality Variability Comparisons 71
Supervisor and Subordinate Comparisons 74
Test-Retest Reliability. 76
Interrater Agreement 78
Intercorrelation Among Abilities 81
Categorical and Magnitude Estimation Scale Comparisons 84
Properties of Scales 90
Combined Profiles 90

Interview Findings 93

Discussion of Pretest Results 98

IV. PERCEPTUAL/PSYCHOMOTOR REQUIREMENTS OF 35 AFSCS 101

Changes in Forms and Procedures 101

Sample 101

Career Fields 101
Air Force Bases 102
Respondent Sample 105
Task Sample 105

Data Collection Instruments 106

Content of Data Collection Forms. 106
Demographic Information 106

Procedures 106

Preparatory Step 106
Administrator Instructions 108

Demographic Description of Sample 108

TABLE OF CONTENTS (cont.)

Page

Supervisor Description 109
Subordinate Description 111

Results 113

Taxonomic Class Means--Amount 113
Taxonomic Class Standard Deviations--Amount 118
"High" and "Low" Ability Requirements 119
Taxonomic Class Means--Performance Quality Variability 122
"High" and "Low" Performance Variability Classes 128
Task Information--Amount 131
Task Information--Performance Quality Variability. . . . 139
Agreement Between Amount and Performance 144
Supervisor-Subordinate Agreement. 159
Profile Similarity. 162
Intercorrelations Among Abilities and Factor Analysis--Amount. 162
Reliability Analysis 166
Stability 168
Rater Error. 168

V. SUMMARY AND CONCLUSIONS 175

Summary 175
Conclusions 176

REFERENCES 179

APPENDIX A - Pretest Forms. 185

APPENDIX B - Interview Form Used In Pretest 197

APPENDIX C - Correlations Among Abilities for Pretest 203

APPENDIX D - Frequency Distributions of Amount Ratings for 13 Perceptual/Psychomotor Abilities in 35 AFSCs 221

APPENDIX E - Frequency Distributions of Performance Quality Variability Ratings for 13 Perceptual/Psychomotor Abilities in 35 AFSCs 227

APPENDIX F - Letter Introducing Survey. 233

LIST OF TABLES

Table Page

2-1 Classification of Behaviors According to the Classification System of Berliner (Rabideau, 1964) . . . 5

2-2 Summary of Harrow's Taxonomy 9

2-3 Rotated Factors Obtained from Psychomotor/Perceptual Battery by Hunter 12

2-4 Rotated Factors Obtained from Combined Psychomotor/Perceptual Battery and Paper-and-Pencil Batteries by Hunter 13

2-5 The Factor-Defined Components of the Motor Domain and the Variables that Best Describe These Factors According to Rarick and Dobbins (1975) 16

2-6 List of Perceptual/Psychomotor Attributes 21

2-7 Total Sum and Sums of the Compatibility and Comprehensiveness Ratings by Rater 27

3-1 Description of Pretest Sample 47

3-2 Task Sampling Procedures for Pretest Career Field 49

3-3 Perceptual/Psychomotor Ability Means and Standard Deviations for the Fire Protection Career Field . . 63

3-4 Ability Means and Standard Deviations for the Munitions Maintenance Career Field 66

3-5 Task Means and Standard Deviations Across Abilities for the Fire Protection Career Field 69

3-6 Task Means and Standard Deviations for Munitions Maintenance Career Field 70

3-7 Range of Values Yielded by Separate Methods and Rater Levels in Two Career Fields 72

3-8 Product Moment Correlation Between Amount and Performance Quality Variability (N = 13 Abilities) 73

3-9 Product Moment Correlation Between Supervisors and Subordinates (N = 13 Abilities) 75

3-10 Coefficients of Agreement Between Two Evaluations of the Same Tasks 77

LIST OF TABLES (cont.)

Table Page

3-11 Percentage Agreement Among Raters for the Perceptual/Psychomotor Abilities on the Categorical Scale Judgments 79

3-12 Percentage Agreement Among Raters for the Perceptual/Psychomotor Abilities on the Magnitude Estimation Scale Judgments 80

3-13 Frequency Distribution of Intercorrelations Among Taxonomic Classes for Amount 82

3-14 Frequency Distribution of Intercorrelations Among Taxonomic Classes for Performance Quality Variability 83

3-15 Product Moment Correlation Between Categorical and Magnitude Estimation Scaling Approaches (N = 13 Abilities) 85

4-1 Sample of Air Force Career Fields by Aptitude Score Minimums 103

4-2 Air Base Sample 104

4-3 Frequency of Supervisors in the Final Sample in 35 AFSCs in Four Aptitude Areas with Median and Mode of Years in their Specialty (AFSC) and Years in the Air Force (AF) 110

4-4 Frequency of Subordinates in the Final Sample in 35 AFSCs in Four Aptitude Areas with Median and Mode of Years in their Specialty (AFSC) and Years in the Air Force (AF) 112

4-5 Means and SDs of Judgments Concerning Amount of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 8 AFSCs and in the Mechanical Aptitude Area 114

4-6 Means and SDs of Judgments Concerning Amount of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the Administrative Aptitude Area 115

4-7 Means and SDs of Judgments Concerning Amount of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the General Aptitude Area 116

LIST OF TABLES (cont.)

Table		Page
4-8	Means and SDs of Judgments Concerning Amount of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the Electronics Aptitude Area	117
4-9	"High" and "Low" Amount of 13 Perceptual/Psychomotor Abilities in 29 AFSCs by Aptitude Areas	120
4-10	Means and SDs of Judgments Concerning Performance Quality Variabilities as a Function of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 8 AFSCs and in the Mechanical Aptitude Area	124
4-11	Means and SDs of Judgments Concerning Performance Quality Variabilities as a Function of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the Administrative Aptitude Area.	125
4-12	Means and SDs of Judgments Concerning Performance Quality Variabilities as a Function of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the General Aptitude Area	126
4-13	Means and SDs of Judgments Concerning Performance Quality Variabilities as a Function of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the Electronics Aptitude Area	127
4-14	"High" and "Low" Performance Quality Variability as a Function of Perceptual/Psychomotor Abilities in 13 AFSCs by Aptitude Area	129
4-15	Frequency of Means of Judgments of Tasks Relative to Amount of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 8 AFSCs and Mechanical Aptitude Area.	133
4-16	Frequency of Means of Judgments of Tasks Relative to Amount of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and Administrative Aptitude Area	134

LIST OF TABLES (cont.)

Table | Page

4-17 Frequency of Means of Judgments of Tasks Relative to Amount of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and General Aptitude Area 135

4-18 Frequency of Means of Judgments of Tasks Relative to Amount of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and Electronics Aptitude Area. 136

4-19 Two Tasks Which Were Highest on Each Perceptual/Psychomotor Ability 137

4-20 Means of Judgments of Tasks Relative to Performance Quality Variability as a Function of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 8 AFSCs and Mechanical Aptitude Area 140

4-21 Means of Judgments of Tasks Relative to Performance Quality Variability as a Function of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and Administrative Aptitude Area. 141

4-22 Means of Judgments of Tasks Relative to Performance Quality Variability as a Function of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and General Aptitude Area 142

4-23 Means of Judgments of Tasks Relative to Performance Quality Variability as a Function of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and Electronics Aptitude Area 143

4-24 Agreement Indices Between Means of Judgments of Amount and of Performance Quality Variability. 157

4-25 Frequency of Occurrence of Ability Means for Amount and of Performance Quality Variability in High and Low Categories. 158

4-26 Correlation (r) Between Amount of 13 Perceptual/Psychomotor Skills and Judgments of Performance Quality Variability 160

14

LIST OF TABLES (cont.)

Table Page

4-27 Correlation Between Supervisor and Subordinate Ratings for Amount (A) and Performance Quality Variability (PQV) Judgments 161

4-28 Percentage of D Scores in Each AFSC Within 10 Percent of the D Range (2.52) or Less. 163

4-29 Intercorrelation Matrix of Amount Ratings Across AFSCs and Tasks for Each Ability 164

4-30 ANOVA Model for Reliability Determination 167

4-31 Reliability of Subordinate and Supervisory Ratings for a Variety of Sample Sizes and AFSCs 169

4-32 Formulas Employed for Estimating Strength of Association (w^2) Between Independent and Dependent Variables. 171

4-33 Strength of Association (w^2) Between Independent and Dependent Variables for Subordinate Raters 172

4-34 Strength of Association (w^2) Between Independent and Dependent Variables for Supervisory Raters 173

LIST OF FIGURES

Figure Page

3-1 Correspondence between two scaling approaches for the Fire Protection specialty on amount 86

3-2 Correspondence between two scaling approaches for the Fire Protection specialty on performance quality variability 87

3-3 Correspondence between two scaling approaches for Munitions Maintenance specialty on amount . . . 88

3-4 Correspondence between two scaling approaches for Munitions Maintenance specialty on performance quality variability 89

3-5 Means and standard deviations of taxonomic classes for Fire Protection career field 91

3-6 Means and standard deviations of taxonomic classes for Munitions Maintenance career 92

3-7 Involvement of perceptual/psychomotor abilities in Fire Protection career field. 94

3-8 Involvement of perceptual/psychomotor abilities in Munitions Maintenance career field 95

4-1 Mean and ±.5 standard deviation for each ability for judgment of amount 145

4-2 Mean and ±.5 standard deviation for each ability for judgment of quality variability 151

LIST OF EXHIBITS

Exhibit Page

4-1 Scales used for parts 1 and 2 of the data collection forms 107

A-1 Sample response page from the data collection forms . . 196

I. INTRODUCTION

A major problem in advanced, technologically oriented organizations, such as the Air Force, is the determination of the ability requirements for job performance. Job descriptions, in terms of ability requirements, support a variety of purposes, such as establishing job entry requirements, classification and assignment, performance evaluation, training requirements derivation, and career development.

This report presents the methods, procedures, and results of a study which sought

1. To develop a perceptual/psychomotor taxonomy of abilities applicable to Air Force career fields.
2. To apply the taxonomy to a variety of Air Force specialties in order to describe the perceptual/psychomotor abilities inherent to the job performance of personnel in these specialties.

While the Air Force routinely collects information about job characteristics through its Comprehensive Occupational Data Analysis Program (CODAP) system (Christal, 1974), this information has not dealt with perceptual/psychomotor requirements. Moreover, although there has been substantial progress toward predicting success in Air Force technical training schools and (to a lesser extent) job performance on the basis of academic/cognitive skills, there has been little, if any, emphasis on prediction based on perceptual/psychomotor abilities. It is quite possible that inclusion of perceptual/psychomotor ability considerations in such predictions would substantially enhance predictive power. This holds, because, on the surface, it seems that perceptual/psychomotor ability is basic to a large part of the performance of Air Force enlisted personnel.

The objective of the present study was to describe the perceptual/psychomotor requirements of 35 Air Force specialties. However, before such requirements could be established, some basic needs had to be met, including:

1. A perceptual/pscyhomotor taxonomy that is defensible, comprehensive, scalable, and applicable to the work of Air Force career fields.
2. A method for economically collecting the information dictated by the taxonomy.

3. An information collection method that met acceptable measurement standards and was reasonably free from error.

Subsequent sections of this report describe the steps taken to meet each of these needs. Then, the methods and results of a survey to establish the perceptual/psychomotor requirements of 35 Air Force specialties are described. These data can now provide a basis for future programs which exploit perceptual/psychomotor performance requirements in the Air Force.

II. TAXONOMY DEVELOPMENT

A taxonomy is a "classification of data according to their natural relationships or the principle governing such classification" (English & English, 1958) or "a way of simplifying a complicated universe of individual events and objects according to some useful way of identifying the way in which groups of individuals (or observations) have things in common or differ" (Miller, 1967). In short, a taxonomy is a classification system. The desirable characteristics in an Air Force oriented behavioral taxonomy, as extrapolated from Miller (1967) and Fleishman (1975), are

1. Compatibility--the scheme should be fully compatible with the Air Force task structure.
2. Understandability--the scheme must be readily apparent and comprehensible to Air Force users.
3. Objectivity--the standards for evaluation must be free from bias.
4. Scalability--the technique should allow for the assignment of a magnitude value (a number) to the tasks of a job relative to each class in the scheme.
5. Practicality--the scheme should be relatively simple to apply and interpret and should not place undue time requirements on operational personnel.
6. Validity--the scheme should be based on acceptable constructs relevant to Air Force job content, and seem reasonable to the Air Force users.
7. Reliability--the scheme should be amenable to psychometrically reliable data acquisition methods.
8. Comprehensive, generality, and flexibility--the scheme should be applicable to the full range of tasks involved in Air Force career fields.
9. Cost effective--the taxonomy should have characteristics that permit it to be embedded within a scheme that is relatively inexpensive to employ and the taxonomy should be purposeful in establishing an appropriate job-personnel interface.
10. Unidimensionality--each skill within the scheme should be unique.

Perceptual/Psychomotor Taxonomies

A number of rather general taxonomies have been developed over the years (Ragsdale, 1950; Fitts, 1962; Simpson, 1972; McCormick, Jeanneret, & Mecham, 1969; Kibler, Barker, & Miles, 1970; Greenstein, 1976). These systems attempted to establish broad categories and classes into which behaviors could be classified. They do not deal with perceptual/psychomotor abilities per se and, therefore, are not reviewed herein.

Major Perceptual Motor Ability Taxonomies Prior to 1968

Prior to 1968, the most important taxonomies developed utilizing perceptual/psychomotor descriptors were those of Berliner (Rabideau, 1966), and Fleishman (1967).

Berliner's Taxonomy

The first formal task classification system utilizing perceptual/psychomotor descriptors is the Berliner three-tier system (see Rabideau, 1964). The Berliner system, shown in Table 2-1, classifies tasks in terms of intervening human processes or functions as related to general work activities and specific behaviors or tasks. The Berliner taxonomy was developed to organize and define the measurement of task performance, and provides a useful scheme for analyzing man-machine systems.

The perceptual motor components in the Berliner system correspond to the processes identified as perceptual and motor. Using such descriptors, the system describes man-machine performance in terms of human behaviors, and outlines the human processes required to perform the tasks. No detailed definitions of the processes are given. The major emphasis is on the human activities. Accordingly, the Berliner taxonomy can best be considered as a behavioral description rather than a behavioral requirements approach to task classification.

Several other authors have followed Berliner in developing similar types of taxonomies, for example, Alluisi (1967) and Chambers (1973). As with Berliner, these two taxonomies utilize perceptual/psychomotor functions, but emphasize the human activities or tasks. Such taxonomic systems suggest the perceptual/psychomotor abilities required to perform tasks. However, the taxonomies are too broad or vague to identify the amount or type of perceptual/psychomotor ability required. Taken together, the three systems appear to be descriptive, nonrigorous, qualitative, and general types of taxonomies. They were subjectively developed and depend heavily on verbal descriptions, with somewhat overlapping functions and behaviors.

21

Table 2-1

Classification of Behaviors According to the Classification System of Berliner (Rabideau, 1964)

Process	Activity	Behaviors
1. Perceptual	a. Searching for and receiving information	a. Detect, inspect, observe, read, receive, scan
	b. Identifying objects, actions, and events	b. Discriminate, identify, locate
2. Mediational	a. Information processing	a. Categorize, calculate, code, compute, itemize, translate
	b. Problem solving and decision making	b. Analyze, select, compare, estimate, plan
3. Communication		Advise, answer, direct, indicate, inform, instruct, request, transmit
4. Motor	a. Simple, discrete	a. Activate, connect, join, move, press, close, set
	b. Complex, continuous	b. Adjust, align, regulate, synchronize, track

Fleishman's Taxonomy

Fleishman and his coworkers (1966, 1975) identified a number of major perceptual/psychomotor abilities as accounting for performance in over 200 types of tasks:

1. Control Precision--muscular adjustments of the large muscle groups, e.g., arm-hand and leg movements. The ability is very important when quick and precise adjustments are required.
2. Multilimb Coordination--involves the use of arm-hand and leg movements. The ability is involved in perceptual-motor tasks where the ability to coordinate the movements of the limbs simultaneously are required.
3. Response Orientation--the ability to move quickly and correctly in response to a stimulus.
4. Reaction Time--the time elapsed between the appearance of a stimulus and the response.
5. Speed of Arm Movement--the time required to execute an arm movement, where accuracy is not required.
6. Rate Control (Timing)--timing motor adjustments in response to changes in moving targets or objects. Compensatory and pursuit movements are involved in this ability, as well as the ability to respond to changes in rate.
7. Manual Dexterity--the ability to perform tasks involving the manipulation of large objects. Skillful arm-hand movements under speeded conditions are also involved.
8. Finger Dexterity--the ability to manipulate small objects with the fingers.
9. Arm-Hand Steadiness--the ability to make accurate movements involving the arm and hand. Only steadiness is an important factor; strength and speed are not involved.
10. Wrist-Finger Speed (Tapping)--the ability to make rapid wrist flexing and finger tapping movements.

[illegible]. Extent Flexibility--forward, backward, and lateral stretching or flexing of trunk and/or back muscles.

12. Dynamic Flexibility--the ability to repeat rapid muscle flexing movements. The ability is critical in the recovery from strain or distortion.

13. Static Strength--the force exerted against objects for a brief period of time. The ability is not involved in supporting one's own body weight.

14. Dynamic Strength--muscular resistance to fatigue. The ability involves muscular endurance when continuous muscular force is required over a considerable period of time.

15. Trunk Strength--the ability involves the trunk and abdominal muscle resistance to fatigue, when use of these muscles is required over a considerable period of time.

16. Explosive Strength--the ability to engage in activities requiring short bursts of energy and strength. Continuous stress or strain, through repeated exertion of muscles, is not involved.

17. Gross Body Coordination--the ability to coordinate the actions of different parts of the body while simultaneously executing gross body movements.

18. Gross Body Equilibruim--the ability to maintain body balance while opposing forces are acting on the body.

19. Stamina (Cardiovascular Endurance)--the ability to engage in physical activity and expend effort over long periods of time.

Fleishman and his colleagues formulated the perceptual/psychomotor abilities and their definitions through a series of interrelated experimental, correlational, and factor analytic studies. He provided (1967) an example of his experimental-factor analytic paradigm by describing the process in the development of the Rate Control ability factor. He found that in early studies this factor was common to compensatory as well as pursuit tasks. To test the factors' generality, tasks were developed to emphasize rate control. The factor was found to extend to such tasks. In later studies the attempt was made to discover if emphasis on this ability is in judging the rate of the stimulus as distinguished from ability to respond at the appropriate rate. A task was developed to investigate this conjecture. Performance on this task did not correlate with other rate control tasks. Finally, a number of motion tasks were adapted which required extrapolation of the course of a plane moving across a screen. This task was found to be unrelated to the tasks previously found to measure "rate control." Accordingly, Fleishman expanded the definition to include measures beyond pursuit tasks, but restricted it to tasks requiring the timing of a muscular adjustment to the stimulus change.

Major Perceptual Motor Ability Taxonomies After 1968

After 1968, other than the work of Fleishman and his associates (1975), four additional perceptual/psychomotor ability task taxonomies were found in the available literature (Harrow, 1972; Hunter, 1975; Rarick & Dobbins, 1975; Pfeiffer, Siegel, Taylor, & Shuler, 1978).

Harrow's Taxonomy

Harrow (1972) presented a comprehensive descriptive taxonomy of perceptual/psychomotor behaviors (Table 2-2). Her system was offered as an aid in classifying movement experiences in children. It arranged behavior from the lowest (reflex) to highest (nondiscursive communication) level of movement activities.

Harrow's taxonomy seems to be a behavioral description task classification system; it describes learning tasks in terms of their logical relationship to perceptual motor behaviors, abilities, or skills. The taxonomy does not define the perceptual/psychomotor ability requirements of tasks, but, as the Berliner system (though at a much finer level), suggests the types of perceptual motor abilities needed to better learn or perform tasks. Harrow, however, did define 10 abilities:

1. Kinesthesis (Muscle Sense)--the feel that goes along with any movement task; an awareness of body or body parts movements.
2. Body Awareness--part of kinesthesis; the ability to recognize and control the body, legs, and arms.
3. Visual Acuity--the ability to receive and differentiate between various stimuli.
4. Visual Tracking--the ability to follow symbols and objects with coordinated eye movements.
5. Visual Memory--the ability to recall past visual experiences and describe them verbally or in writing.

Table 2-2

Summary of Harrow's Taxonomy[a]

Perceptual Motor Categories and Subcategories

Category	Subcategory	Definition	Behavioral Activity
1. Reflex Movements	a. Segmental b. Intersegmental c. Suprasegmental	Reactions to stimuli elicited without conscious effort	Contracting, straightening limbs, stretching, adjusting posture
2. Basic-Fundamental Movements	a. Locomotor	Complex, skilled movement formed from a combination of reflex movements	a. Sprinting, running, leaping, skipping, jogging, scaling
	b. Nonlocomotor		b. Pushing, pulling, tilting, lifting, bending, canting
	c. Manipulative		c. Operating with hands, gripping, manipulating, grasping
3. Perceptual Abilities	a. Kinesthetic	Interpreting stimuli of various different modalities for the purpose of adjusting to the environment	a. Continual body adjustments to maintain balance as in log rolling
	b. Visual		b. Running from an oncoming car
	c. Auditory		c. Answering a verbally posed question
	d. Tactile		d. Determining the shape of an object by touching
	e. Coordination		e. Throwing and catching a ball
4. Physical Abilities	a. Endurance	The physical energy required in executing highly skilled physical movements	a. Activities requiring physical effort for long periods as in bicycle racing
	b. Strength		b. Activities requiring excessive use of muscles as in boxing
	c. Flexibility		c. Activities requiring hip joint motion as in gymnastics
	d. Agility		d. Activities requiring accurate, precise movement as in stenotyping

Table 2-2 (Cont.)

5. **Skilled Movements**	a. Simple b. Compound c. Complex	Performing tasks of intricate and involved movement based on basic movement patterns	Activities which build on "Basic Fundamental Movements" (Category 2) as in athletics, dancing, and painting
6. **Nondiscursive Communication**	a. Expressive movement b. Interpretive movement	Communicating through body movements and facial expressions	Posture, body gestures, grimaces, sign language, and dance

[a] Adapted from Harrow (1972).

6. Figure-Ground Discrimination--the ability to select the dominant figure from the surrounding background.
7. Perceptual Constancy--the ability to recognize familiar symbols when presented in a novel manner or size.
8. Auditory Acuity--the ability to discriminate between sounds of pitch and intensity differences.
9. Auditory Tracking--the ability to locate sounds and track their direction and movements.
10. Auditory Memory--the ability to recognize and reproduce (e.g., verbally) past auditory experiences.

Though restricted more to the perceptual side of perceptual/p chomotor abilities, Harrow's 10 abilities can be included in a more c prehensive list of perceptual/psychomotor abilities. For example, th can be included with Fleishman's 19 abilities, which emphasize the m tor end of the perceptual/psychomotor ability dimension.

Hunter's Taxonomy

Hunter (1975) defined 11 ability factors through factor analysis of the results of seven perceptual/psychomotor apparatus tests and 21 paper-and-pencil tests. A major purpose was to compare the factorial structure of apparatus tests with the factorial structure of paper-and-pencil tests. The results showed that the two test batteries shared little common variance. Six ability factors were specific to the perceptual/psychomotor apparatus battery, four factors were specific to the paper-and-pencil measures, and one factor was common to both batteries. First, seven factors were extracted and rotated from the perceptual/psychomotor apparatus battery analysis: (a) Visual Tracking, (b) Auditory Tracking, (c) Figural Memory, (d) Position Memory, (e) Motor Speed, (f) Associate Speed, and (g) Perceptual Speed. The factors were defined by those apparatus tests (labeled Test 1 to Test 7) which loaded highly (i.e., > ± .30) on the respective factors (Table 2-3).

When Hunter factor analyzed the combined perceptual/psychomotor apparatus and the paper-and-pencil batteries, 11 rotated factors were obtained (Table 2-4): (a) Verbal, (b) Spatial Relations, (c) Visual Tracking, (d) Figural Memory, (e) Auditory Tracking, (f) Mechanical, (g) Associative Speed, (h) Motor Speed, (i) Manual Dexterity I, (j) Manual Dexterity II, and (k) Perceptual Speed.

Table 2-3

Rotated Factors Obtained from Psychomotor/Perceptual Battery by Hunter [a]

Variable	Factor Loading	Variable	Factor Loading
Factor I (Visual Tracking)		Factor II (Auditory Tracking)	
Test 7 Performance Under Divided Attention-Line Error Minute 2	.93	Test 7 Performance Under Divided Attention-Tone Error Minute 2	.83
Test Performance Under Divided Attention-Line Error Minute 3	.91	Test 7 Performance Under Divided Attention-Tone Error Minute 3	.82
Test 7 Performance Under Divided Attention-Line Error Minute 1	.89	Test 7 Performance Under Divided Attention-Tone Error Minute 4	.82
Test 7 Performance Under Divided Attention-Line Error Minute 4	.89	Test 7 Performance Under Divided Attention-Tone Error Minute 1	.81
Factor III (Figural Memory)		Factor IV (Position Memory)	
Test 5, Memory (Delayed) Part 2	.85	Test 2, Perceptual Speed-Correct Answers	.84
Test 5, Memory (Immediate) Part 1	.83	Test 1, Kinesthetic Memory-Correct Answers	.63
Test 3, Performance Under Stress Correct Answers	.51		
Test 2, Perceptual Speed-Response Time	-.41	Factor VI (Motor Speed)	
Test 1, Kinesthetic Memory-Correct Answers	.36	Test 3, Performance Under Stress-Response Time	.90
Test 2, Perceptual Speed-Perception Time	-.36	Test 2, Perceptual Speed-Response Time	.71
Factor V (Associative Speed)		Factor VII (Perceptual Speed)	
Test 4, Associative Learning Part 1	-.69	Test 3, Performance Under Stress-Perception Time	.90
Test 1, Kinesthetic Memory-Response Time	.68	Test 2, Perceptual Speed-Perception Time	.70
Test 4, Associative Learning Part 2	-.54		
Test 6, Concept Identification-Correct Answers	-.45		
Test 2, Perceptual Speed-Perception Time	.32		

[a] Taken from Hunter (1975).

Table 2-4

Rotated Factors Obtained From Combined Psychomotor/Perceptual Battery and Paper-and-Pencil Batteries by Hunter[a]

Variable	Factor Loading	Variable	Factor Loading
Factor I (Verbal)		Factor II (Spatial Relations)	
Word Knowledge	-.81	Hidden Figures	.68
Verbal Analogies	-.76	Pattern Detail	.65
Word Grouping	-.73	Figure Analogies	.63
Letter Sets	-.56	Rotated Blocks	.58
Scale Reading	-.55	Electrical Maze	.50
Electrical Information	-.45	Block Counting	.42
Table Reading	-.40	Point Distance	.37
Mechanical Principles	-.40	Letter Sets	.37
Figure Analogies	-.39	Scale Reading	.33
Test 6, Concept Identification-Correct Answers	-.35	Mechanical Principles	.31
Block Counting	-.35		
Factor III (Visual Tracking)		Factor IV (Figural Memory)	
Test 7, Performance Under Divided Attention-Line Error, Minute 2	.92	Test 5, Memory Part 1 (Immediate)	.74
Test 7, Performance Under Divided Attention-Line Error, Minute 3	.91	Test 5, Memory Part 2 (Delayed)	.71
Test 7, Performance Under Divided Attention-Line Error, Minute 1	.89	Test 1, Kinesthetic Memory-Correct Answers	.56
Test 7, Performance Under Divided Attention-Line Error, Minute 4	.88	Test 3, Performance Under Stress-Correct Answers	.50
		Discrimination-Reaction	.49
		Answer Sheet Marking, Rights	.49
		Table Reading	.49
		Test 2, Perceptual Speed-Response Time	-.46
		Test 2, Perceptual Speed-Correct Answers	.44
		Block Counting	.37
		Point Distance	.36
		Test 2, Perceptual Speed Perception Time	-.35
		Letter Sets	.31

Table 2-4 (cont.)

Factor V (Auditory Tracking	
Test 7, Performance Under Divided Attention-Tone Error, Minute 2	.81
Test 7, Performance Under Divided Attention-Tone Error, Minute 3	.81
Test 7, Performance Under Divided Attention-Tone Error, Minute 1	.81
Test 7, Performance Under Divided Attention-Tone Error, Minute 4	.79

Factor VI (Mechanical)	
Tools	-.75
Tool Functions	-.74
Electrical Information	-.62
Mechanical Principles	-.55
Electrical Maze	-.31

Factor VII (Associative Speed)	
Test 4, Associative Learning Part 1	-.60
Test 1, Kinesthetic Memory-Response Time	.55
Test 4, Associative Learning Part 2	-.48

Factor VIII (Motor Speed)	
Test 3, Performance Under Stress-Response Time	.85
Test 2, Perceptual Speed-Reseponse Time	.65

Factor IX (Manual Dexterity I)	
Answer Sheet Markings, Wrongs	.86
Answer Sheet Markings, Rights	-.39
Test 2, Perceptual Speed-Correct Answers	-.35

Factor X (Manual Dexterity II)	
Large Tapping	-.78
Trace Tapping II	-.71
Answer Sheet Marking, Rights	-.42
Discrimination-Reaction	-.33
Table Reading	-.33

Factor XI (Perceptual Speed)	
Test 3, Performance Under Divided Attention-Perception Time	.84
Test 2, Perceptual Speed-Perception Time	.72
Test 6, Concept Identification-Correct Answers	-.33

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[a] Taken from Hunter (1975).

Thus, examining the factors in Table 2-3 and Table 2-4 together, shows that: (a) five factors are predominantly identified by apparatus tests (i.e., Visual Tracking, Auditory Tracking, Motor Speed, Associative Speed, and Perceptual Speed), (b) five factors were mostly identified with paper-and-pencil tests; Verbal, Spatial Relations, Mechanical, and Manual Dexterity (I and II), and (c) one factor--Figural Memory--was identified by both apparatus tests and paper-and-pencil tests nearly equally. Hunter (1975) claimed such a factor configuration was encouraging since it suggests that apparatus tests may make a unique and significant contribution (over paper-and-pencil tests) to the prediction of success and failure in technical training and work. Indeed, in a later study, Hunter, Maurelli, and Thompson (1977) showed several of the same perceptual/psychomotor measures as predictive of performance in technical training schools.

Rarick and Dobbins' Taxonomy

Another perceptual/psychomotor ability taxonomy, based on factor analysis of a group of tests, was reported by Rarick and Dobbins (1975). As did Hunter, they described four perceptual/psychomotor ability factors based on the factor loadings of each test on each factor (Table 2-5).

Noting that the Rarick and Dobbins (1975) taxonomy contains more gross levels of abilities than does Hunter's (1975), the results of any factor analytic study may be inferred to be rather situation specific. The number and types of tests employed, along with the sample of subjects used and conditions of testing, limit the scope and definition of the factors eventually extracted. To increase comprehensiveness and generality, additional factor analytic studies are needed which examine different tests, different subject samples, and different test conditions.

Applied Psychological Services' Taxonomy

At Applied Psychological Services (Pfeiffer, Siegel, Taylor, & Shuler, 1978), a task taxonomy was developed to categorize tasks on the basis of their perceptual/psychomotor ability requirements. The taxonomy was developed with reference to military tasks and was deliberately limited to categories about which there is considerable background. The included abilities and their respective definitions are:

1. Vision--the ability to visually detect objects and relations among objects such as movement or relative distances.

Table 2-5

The Factor-Defined Components of the Motor Domain and the Variables that Best Describe These Factors According to Rarick and Dobbins (1975)[a]

Factor Name	Variables
1. Strength-Power-Body Size	Weight, body dimensions, right and left grip dynamometer strength, bicycle ergometer (number of revolutions in 90 seconds, Res. = 1.5kp)
2. Gross Body Coordination	Perpendicular jump, 35 yard sprint, broad jump, scramble, 15[illegible] yard dash
3. Fine Motor Abilities	Adapted Minnesota Manipulative, Purdue-Pegboard, Two-Plate Tapping Test, Ring Stacking Test, Golf Ball Transfer Test
4. Balance	Rail balance forward, rail balance backward, rail balance sideways, one leg balance

[a] Adapted from Rarick and Dobbins (1975)

2. Hearing--the ability to detect significant sounds amid competing sounds.
3. Strength--the ability to move objects using the body and limbs.
4. Impulsion--the ability to react quickly to light and sound by making explosive movements such as tapping, running, and jumping.
5. Motor Speed--the ability to maintain a high personal tempo and perform accurately using arms, hands, and fingers.
6. Static Precision--the ability to maintain good body balance and arm steadiness while aiming.
7. Dynamic Precision--the ability to maintain body balance and make accurate aiming movements while the body is in motion.

Miscellaneous: General Test Batteries

The final set of perceptual/psychomotor ability concepts reviewed here concerns those attributes measured within published general test batteries. Five major test batteries were identified as possessing relevant perceptual/psychomotor ability measures.

General Aptitude Test Battery (GATB)

The GATB was developed by the United States Employment Service. It was constructed primarily for vocational and employment counseling purposes, and includes 12 separately timed tests. The perceptual motor ability factors included

1. Form Perception--the ability to perceive pertinent detail in objects or in pictorial or graphic material; to make visual comparisons and discriminations and to see slight differences in shapes and shadings of figures and widths and lengths of lines.
2. Clerical Perception--the ability to perceive pertinent detail in verbal or tabular material; to observe differences in copy, to proofread words and numbers, to avoid perceptual errors in arithmetic computation.

3. Motor Coordination--the ability to coordinate eyes and hands or fingers rapidly and accurately in making precise movements with speed; to make a movement response accurately and quickly.
4. Finger Dexterity--the ability to move the fingers; to manipulate small objects with the fingers, rapidly or accurately.
5. Manual Dexterity--the ability to move the hands easily and skillfully; to work with the hands in placing and turning motions.

Differential Aptitude Tests (DAT)

The DAT is a widely used, general aptitude test battery. Unlike the GATB, the DAT was developed more to measure vocational aptitude than to aid in vocational placement. Consequently, the DAT measures many more cognitive and "intellectual" abilities than does the GATB. Of eight tests, only one appears to measure a perceptual or psychomotor factor: Clerical Speed and Accuracy--the ability to respond quickly and accurately to simple visual perceptual tasks.

Flanagan Aptitude Classifications Tests (FACT)

The FACT was developed on the basis of actual job behaviors and critical work incidents. There are 14 so-called "job element" tests aimed primarily at semiskilled, skilled, and clerical functions. Eight tests can be taken as measures of perceptual/psychomotor abilities:

1. Inspection--the ability to spot flaws or imperfections in a series of articles quickly and accurately. The test is designed to measure the type of ability required in inspecting finished or semi-finished, manufactured items.
2. Coding--the speed and accuracy of coding typical office information. A high score can be obtained either by learning the codes quickly or by speed in performing a simple clerical task.
3. Memory--the ability to learn and remember the codes given in the coding test; the ability to memorize printed materials.

4. Precision--speed and accuracy in making very small, circular, finger movements with one hand; and with both hands working together. The test samples the ability to do precision work with small objects.
5. Scales--speed and accuracy in reading scales, graphs, and charts. The test measures scale-reading of the type required in engineering and similar technical occupations.
6. Coordination--the ability to coordinate hand and arm movements; to control movements in a smooth and accurate manner when these movements must be continually guided and readjusted in accordance with observations of their results.
7. Patterns--the ability to reproduce simple pattern outlines in a precise and accurate way. Part of the test requires the ability to sketch a pattern as it would look if it were turned over.
8. Components--the ability to identify important component parts. The samples used are line drawings and blueprint sketches. This performance represents the ability to identify components in other types of complex situations.

Employee Aptitude Survey (EAS)

As the name implies, the EAS was developed specifically for industrial application, in particular, employee selection. The EAS possesses 10 short, factor analytically derived tests--three of which can be identified as measuring perceptual/psychomotor attributes:

1. Visual Pursuit--the ability to quickly and accurately trace lines visually through an entangled network.
2. Visual Speed and Accuracy--the ability to see small details quickly and accurately, as required in visual inspection and clerical work.
3. Manual Speed and Accuracy--the ability to make fine finger movements rapidly and accurately.

Guilford-Zimmerman Aptitude Survey

The Guilford-Zimmerman Aptitude Survey is the final test battery considered. One of its seven tests appears to measure a perceptual/psychomotor ability: Perceptual Speed--the ability to see visual details quickly and accurately by matching identical sketches of everyday objects.

The perceptual/psychomotor measures within each of the five batteries reviewed provide well defined attributes. The batteries possess a strong research data base and, except for the FACT, define their measures through factor analysis. As with Hunter (1975) and Rarick and Dobbins (1975), however, they are not comprehensive taxonomic systems, but represent a few selected dimensions. The perceptual abilities are operationally defined by the test batteries and lack, to some degree, conceptual meaning outside the tests themselves. In developing a more generally useful taxonomy, the value of the test measures rests in the perceptual/psychomotor ability concepts that can be derived and adapted independent of the test batteries.

Suggested Taxonomy for Determining the Perceptual/Psychomotor Ability Requirements in Selected Air Force Specialties

Taken together, the literature review yielded 89 perceptual/psychomotor abilities that are not unique. Added to this, a list of 17 perceptual/psychomotor abilities which are representative of the abilities required for task performance in Air Force specialties was provided as part of the contract. Accordingly, a total of 106 perceptual/psychomotor abilities was on hand (Table 2-6), from which a final taxonomy was developed for employment in subsequent phases of the present work. The taxonomy was chosen through the following seven-step procedure:

1. Identical and apparently redundant abilities were combined on this list; 31 items were thus combined.
2. Vaguely defined and grossly categorized abilities were eliminated from the list; two were elminated.
3. Abilities unrelated to the perceptual/psychomotor domain and nonrepresentative of the ability requirements in Air Force career fields were eliminated; 12 were eliminated.

Table 2-6

List of Perceptual/Psychomotor Attributes

I Berliner (Rabideau, 1964)

1. Perceptual Processes[b]
2. Motor Processes[b]

II Fleishman (1966)

3. Control Precision
4. Multi Limb Coordination
5. Response Orientation
6. Reaction Time
7. Speed of Arm Movement
8. Rate Control (Timing)
9. Manual Dexterity[a]
10. Finger Dexterity
11. Arm-Hand Steadiness
12. Wrist-Finger Speed (Tapping)
13. Aiming (Eye-Hand Coordination)
14. Extent Flexibility
15. Dynamic Flexibility
16. Static Strength
17. Dynamic Strength
18. Trunk Strength
19. Explosive Strength
20. Gross Body Coordination
21. Gross Body Equilibrium
22. Stamina (Cardiovascular Endurance)

III Harrow (1972)

A. 23. Segmental Reflexes[c]
24. Inter-segmental Reflexes[c]
25. Supra-segmental Reflexes[c]
26. Locomotor Movements[c]
27. Non-Locomotor Movements[c]
28. Manipulative Movements[c]
29. Kinesthetic Discrimination
30. Visual Discrimination
31. Auditory Discrimination
32. Tactile Discrimination
33. Coordinated Abilities[c]
34. Endurance[a]
35. Strength
36. Flexibility
37. Agility
38. Simple Adaptive Skill[c]
39. Compound Adaptive Skill[c]
40. Complex Adaptive Skill[c]
41. Expressive Movement[c]
42. Interpretive Movement[c]

Table 2-6 (cont.)

B. 43. Kinesthesis[a]
- 44. Body Awareness[c]
- 45. Visual Acuity
- 46. VIsual Tracking
- 47. Visual Memory
- 48. Figure Ground Discrimination
- 49. Perceptual Constancy
- 50. Auditory Acuity
- 51. Auditory Tracking
- 52. Auditory Memory

IV Hunter (1975)

- 53. Visual Tracking[a]
- 54. Auditory Tracking[a]
- 55. Figural Memroy
- 56. Position Memory
- 57. Motor Speed[a]
- 58. Associate Speed
- 59. Perceptual Speed
- 60. Gross Manual Dexterity*
- 61. Fine Manual Dexterity*

V Rarick and Dobbins (1975)

- 62. Strength-Power-Body-Size[a]
- 63. Gross Body Coordination[a]
- 64. Fine Motor Abilities[a]
- 65. Balance[a]

VI Pfeiffer, Siegel, Taylor, and Schuler (1978)

- 66. Vision
- 67. Hearing
- 68. Strength[a]
- 69. Impulsion
- 70. Motor Speed
- 71. Static Precision
- 72. Dynamic Precision

VII Miscellaneous: General Test Batteries

A. GATB

- 73. Form Perception
- 74. Clerical Perception
- 75. Motor Coordination[a]
- 76. Finger Dexterity[a]
- 77. Manual Dexterity[a]

B. DAT

- 78. Clerical Speed and Accuracy[a]

Table 2-6 (cont.)

C. FACT

79. Inspection[a]
80. Coding
81. Precision[a]
82. Scales
83. Coordination[a]
84. Patterns
85. Components[a]

D. EAS

86. Visual Pursuit
87. Visual Speed and Accuracy
88. Manual Speed and Accuracy[a]

E. Guilford Zimmerman Aptitude Survey

89. Perceptual Speed[a]

VIII USAF Representative Perceptual Motor Abilities

90. Multi Limb Coordination[a]
91. Reaction Time[a]
92. Control Precision[a]
93. Rate Control[a]
94. Manual Dexterity[a]
95. Finger Dexterity[a]
96. Arm-Hand Steadiness[a]
97. Wrist-Finger Speed[a]
98. Aiming[a]
99. Depth Perception
100. Near Visual Acuity
101. Far Visual Acuity
102. Size Perception
103. Sensory Acuity
104. Color Vision
105. Long Term Memory
106. Short Term Memory

Notes: * Hunter (1975) labels these as Manual Dexterity I and Manual Dexterity II.
[a] Eliminated in Step 1 of Taxonomy Derivation.
[b] Eliminated in Step 2 of Taxonomy Derivation
[c] Eliminated in Step 3 of Taxonomy Derivation.

4. The remaining 61 abilities were rated on the following eight criteria:

   a. Compatibility--the ability should be fully compatible with the Air Force task structure.

   b. Understandability--the ability must be readily apparent and comprehensible to Air Force users.

   c. Objectivity--the ability should allow for standards of evaluation which are free from bias.

   d. Scalability--the ability should allow for the assignment of a magnitude value (a number) to the tasks of a job relative to the amount of the ability required for performance.

   e. Validity--the ability should be based on acceptable constructs, relevant to Air Force job content, and seem reasonable to Air Force users.

   f. Reliability--the ability should be amenable to psychometrically reliable data acquisition methods.

   g. Comprehensiveness--the ability should be applicable to the full range of tasks involved in Air Force career fields.

   h. Unidimensionality--the ability should be unique.

   Two other possible criteria--practicality and cost-effectiveness--were excluded since each directly concerns whole taxonomic systems rather than the individual abilities.

   Independent ratings of each remaining perceptual/psychomotor ability on each criterion were made by two psychologically trained and experienced raters who possessed knowledge of the different types of Air Force career fields and the tasks performed in them. The ratings were made on a 5-point scale, where:

5 = the ability fully meets the criterion
4 = the ability largely meets the criterion
3 = the ability meets the criterion to a moderate extent
2 = the ability meets the criterion minimally
1 = the ability hardly meets the criterion at all

Both the order of the abilities and the criteria on the rating sheets were altered between the two raters.

Although each ability was rated on eight criteria (488 ratings), a degree of variation which was useful for discrimination between abilities existed on only two criteria: compatibility and comprehensiveness. Accordingly, subsequent steps in selection of abilities concerned only these criteria.

5. The independent ratings provided by the two raters on compatibility and comprehensiveness were compared to determine the agreement and disagreement between the raters.

   Agreement was defined as a difference between raters of one scale point or less, while disagreement was defined as a difference of two or more scale points. All rating disagreements were resolved in conference by the two raters. There was a total of 28 disagreements out of a possible 122 ratings (2 x 61) and hence, 77% of the ratings were in agreement as defined.

6. The ratings were summed across the criteria of compatibility and comprehensiveness and two raters for each ability (Table 2-7) to determine the cutoff points which included the top rated perceptual abilities and top rated psychomotor abilities.[1]

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[1] A perceptual/psychomotor ability was classified either as perceptual or psychomotor on the basis of its emphasis on stimulus or response properties. Those abilities more concerned with the stimuli and sensory systems were labeled perceptual; those more involved with the response were called psychomotor.

The cutoff point for the perceptual abilities was 12, which included 16 abilities; for motor abilities the cutoff was 10, which included 17 abilities. Table 2-7 identifies the top-rated perceptual and psychomotor abilities.

7. The final set of perceptual/psychomotor abilities was selected.

   Both raters examined each of 33 top rated perceptual/psychomotor abilities to determine their overall acceptability and desirability for inclusion in the taxonomy.

In the last step, the raters in conference examined the top-rated abilities, as well as the lower-rated abilities, and judged each. This process led to the elimination of several top-rated abilities and the addition of a few lower-rated abilities. Several ground rules were imposed for application during this process:

1. Exclude the more physical, strength, and balance oriented abilities.
2. Combine similarly defined and closely related abilities.
3. Include more specifically defined abilities in the place of grosser and more broadly defined abilities.

Together, the judgments and decisions brought the total list of abilities down to 13. These final 13 abilities and their respective definitions are as follows:

1. Control Precision--the ability to perform rapid, precise, fine controlled adjustments by either arm and hand movements or leg movements.
2. Manual Dexterity--the ability to perform skillful, well-directed arm and hand movements to manipulate either fairly large or fairly small objects under speeded conditions.
3. Finger Dexterity--the ability to perform skillful manipulations of small objects with the fingers.

Table 2-7

Total Sum and Sums of the Compatibility and Comprehensiveness Ratings by Rater

	Rater 1	Rater 2	Total
Control Precision[b]	7	7	14
Multi Limb Coordination[b]	4	6	10
Response Orientation[b]	4	5	9
Reaction Time[b]	6	8	14
Speed of Arm Movement[b]	5	7	12
Rate Control (Timing)[b]	4	6	10
Gross Manual Dexterity[b]	10	8	18
Finger Dexterity[b]	7	7	14
Arm-Hand Steadiness	6	7	13
Wrist-Finger Speed (Tapping)[b]	5	7	12
Extent Flexibility	3	4	7
Dynamic Flexibility	4	5	9
Static Strength[b]	5	5	10
Trunk Strength	4	5	9
Explosive Strength[b]	5	5	10
Gross Body Coordination[b]	7	7	14
Gross Body Equilibrium[b]	5	5	10
Dynamic Strength[b]	5	6	11
Strength[b]	5	5	10
Flexibility	5	6	11
Agility	5	4	9
Kinesthetic Memory	4	6	10
Visual Acuity[a]	8	8	16
Visual-Tracking	4	6	10
Visual Memory	7	7	14
Figure Ground Discrimination	6	4	10
Perceptual Constancy	5	4	9
Auditory Acuity	5	5	10
Auditory Tracking	3	4	7
Auditory Memory	4	4	8
Figural Memory	6	5	11
Position Memory	4	5	9
Motor Speed[b]	6	8	14
Associate Speed	5	6	11
Perceptual Speed[a]	6	7	13
Impulsion	5	5	10
Static Precision	5	5	10
Dynamic Precision	3	3	6
Vision[a]	8	7	15
Hearing[a]	8	6	14
Form Perception[a]	7	6	13
Clerical Perception[a]	6	6	12
Scales[a]	6	6	12

Table 2-7 (cont.)

Visual Pursuit	5	3	8
Visual Speed & Accuracy[a]	7	7	14
Depth Perception[a]	7	5	12
Near Visual Acuity[a]	9	8	17
Far Visual Acuity[a]	8	7	15
Size Perception[a]	7	8	15
Sensory Acuity	6	6	12
Color Vision[a]	7	7	14
Short Term Memory[b]	8	7	15
Long Term Memory[b]	7	7	14
Fine Manual Dexterity[b]	7	7	14
Patterns	5	5	10
Coding	4	5	9
Aiming	4	6	10
Kinesthetic Discrimination	4	6	10
Visual Discrimination[a]	8	8	16
Tactile Discrimination	5	6	11
Auditory Discrimination[a]	6	7	13

a top rated perceptual abilities.
b top rated psychomotor abilities.

4. Multilimb Coordination--the ability to coordinate the movements of a number of limbs simultaneously, e.g., two hands, two feet, and hands and feet together.

5. Rate Control (Tracking)--the ability to perform continuous anticipatory motor adjustments relative to changes in speed and direction of a continuously moving object.

6. Visual Speed and Accuracy--the ability to perceive small details quickly and accurately.

7. Visual Memory--the ability to recall and state verbally or recall and reproduce through writing and drawings based on past visual experiences.

8. Position Memory--the ability to recall rapidly and accurately the position of objects from past experience.

9. Auditory Discrimination--the ability to discriminate and interpret sounds.

10. Auditory Memory--the ability to recognize and reproduce either verbally or in writing prior auditory experiences.

11. Clerical Perception--the ability to read or copy rapidly and accurately pertinent details in scales, graphs, or charts.

12. Perception of Size and Form--the ability to see slight differences in the size and shape of objects.

13. Depth Perception--the ability to determine the position of objects in space and to perceive in three dimensions.

16

Measurement Considerations

Because the present work sought to apply the derived taxonomy to specific Air Force specialties and tasks within specialties, it seemed necessary (a) to set into focus any measurement problems associated with such application and (b) to derive a scaling method for quantifying the extent to which each skill (taxonomic category) is associated with each task.

Theoretic Issues

"When you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind." The positive application of Lord Kelvin's dictum has enabled the psychological sciences to progress from the stage of observation and classification to one of ever-increasing quantitativeness. But in the search for quantitative rigor, the investigator has often found that, for "numbers" to be meaningful, there is a requirement for constructing a scale.

According to Ekman (1968), there are three main research problems in modern psychophysics and scaling. They include stimulus-response relations, psychophysiological relations, and response-response relations.

Stimulus-response relations belong in the classical Fechnerian tradition. The problem here is to establish the functional relation between the stimulus (S) and the response (R). An example might be the relationship between judgment of elapsed time (R) and actual elapsed time (S).

Psychophysiological relations have been studied less frequently than S-R relations. An example of a psychophysiological relation is the relationship between an affective response and the corresponding activity of the sensory nervous system.

Response-response relations concern the functional relationship between subjective variables. In this case, only behavioral or psychological responses to variables are measured. In fact, the physical continuum against which the psychological continuum is compared may be unknown or not even exist as a measurable scale. In an early article, Guilford (1939) contrasted the more common S-R research with R-R research and pointed to the importance of establishing response-response relationships. Relationships between perceived task attributes and perceived training requirements are examples of R-R research. When doing R-R research, the development of such a scale involves: (a) definition of a psychological attribute, (b) quantification of the attribute, and (c) establishment of the relationship of the attribute with a second psychological dimension. Moreover, it is necessary not only to quantify the psychological attribute but also to specify the conditions under which the quantification may hold. Examples of perceived dimensions might be estimated training time required, number of components in a unit or system, ratio of satisfactory to unsatisfactory job performances, estimated time to perform a given repair or replacement, or, in the present case, the amount of a specific skill required to perform a task.

Scaling Classes

Regardless of the type of problem involved, all scaling methods can be placed into one of three classes. The classes are represented by scaling methods designed to produce an ordinal scale, interval scale, or ratio scale of measurement. With appropriate transformations and some assumptions, an interval scale is produced by such methods as paired comparison and rank order, and a ratio scale is produced directly by the methods of magnitude estimation and constant sum.

Representative Scaling Approaches

For the purpose of assigning the extent to which various taxonomic categories are involved in Air Force tasks, at least five scaling methods are possible.

1. The rank order method refers to a procedure in which stimuli are hierarchically arranged by an observer along some continuum. This method is distinctive because all of the stimuli to be categorized are present for simultaneous observation. Application of the method results in a category scale or an interval scale (with transformation).
2. The paired comparison method refers to a procedure in which the stimuli to be evaluated are presented to an observer in all possible pairs. This method results in a category scale or, with the statistical treatment, in an interval scale. An important difference between such category methods as paired comparison and rank order is that the former permits the same category to be used more than once, whereas the latter may not.

3. In category scaling, the judge assigns each stimulus to one of a number of discrete categories which form a continuum; e.g., "always," "sometimes," "never." Any number of categories may be employed, but five or seven categories are used most frequently. The result is an ordinal scale which some treat as an interval scale.
4. Magnitude estimation refers to a procedure in which an observer makes a series of direct numerical estimates of subjective impressions. Each rater is presented with a series of stimuli and is asked to assign numbers proportional to the apparent magnitude of the stimuli. One variation of this method permits all stimuli to be present for simultaneous observation; another presents the stimuli one at a time.
5. The constant sum method refers to a procedure in which all stimuli to be evaluated on a psychological scale are presented to an observer in all possible pairs. The task is to divide a total of 100 points among the members of the set. The immediate numerical result of this procedure is a scale value for each stimulus and also the ratio of all possible pairs of stimuli to one another.

The first three methods are indirect or category approaches to scaling, whereas the fourth and fifth methods are direct or magnitude approaches. For a more complete treatment, the reader is referred to Guilford (1954) or Torgerson (1958).

Magnitude methods and category judgment methods seem to be the mainstay of modern scaling applications. New methodological developments have been few (Cliff, 1973).

Types of Continua

Since the 1957 article of Stevens and Galanter, contemporary psychophysics has faced the embarrassing fact that the two classes of scaling procedures are often unable to produce the same scale of sensory magnitude (Galanter & Messick, 1961). According to Stevens and Galanter (1957), the relation between category and magnitude scales is nonlinear for one class of perceptual continua, whereas for another class of perceptual continua the relation may be linear (p. 377).

Class I (prothetic) continua are characterized by a nonuniformity of discriminal sensitivity along the entire length of the continuum, i. e., the subject is more sensitive to differences at the low end of the scale than at the high end. One would thus expect the just noticeable difference between stimuli to be greater at the upper end of the scale than at the lower end of the scale. Class I probably includes the dimensions that are ordinarily called quantitative, e.g., length and weight (Stevens, 1961).

Class II (metathetic) continua are characterized by a uniformity of discriminal sensitivity along the entire range of the continuum, i.e., there is uniformity of discrimination by an observer over the entire range. One would thus expect the just noticeable difference to remain approximately constant. Class II probably includes the dimensions that are ordinarily called qualitative, e.g., pitch and visual inclination (Stevens, 1961) or job complexity (Pfeiffer & Siegel, 1966a).

For Class II (metathetic) continua, the category scale may be a linear function of the magnitude scale, whereas on Class I (prothetic) continua, one scale should be a logarithmic function of the other scale (Galanter & Messick, 1961).

Relating One Scale to Another

There is also a problem when data derived from one scaling method are related to those derived from another scaling method. Across-method comparisons do not always yield a consistent set of results.

Generally, most studies suggest that scales obtained by the category methods are usually logarithmic transformations of ratio estimation scales. According to early studies cited by Ekman and Sjoeberg (1965), these results have held true even for stimuli whose physical correlates are quite complex. For example, Whitlock (1963), who evaluated job performance, found his data to satisfy one criterion for prothetic continua. When he compared category and magnitude methods on a continuum of apparent desirability of performance of employees, a concave downward curvilinear function was obtained.

More recent evidence has indicated a variety of relations between ratio and category scales. While John (1969) found the usual logarithmic relation between category ratings and magnitude estimates of loudness, Sjoeberg (1968a, 1968b) found linear relations among magnitude scales and category scales of facial expressions when one type of analysis was performed and curvilinear relations in another study. Gregson, Mitchell, Simmonds, and Wells (1969) found that, when two anchors were given for ratio judgments of odors, the scale acted like a category scale.

Montgomery (1975) summarized studies in which the importance of methodological differences between category rating and magnitude estimation was examined. In one study, the form of a scale obtained by a direct estimation procedure was found to vary with: (a) the range of responses actually used by the subject, and (b) the amount of freedom in choosing a highest number. When the category rating and a magnitude estimation task were procedurally similar in both respects, the resulting scales were linearly related to each other.

Gibson and Tomko (1972) showed that category and magnitude scales were linearly related when the end points of the category scale were selected in such a way that they coincided with the previously determined range of magnitude estimates.

According to Montgomery (1977), given a constant Weber function for the category scale, the category scale is quite close to the Fechner integral of the Weber function of the magnitude scale. From this, it might be inferred that the general psychophysical differential equation is valid for the relationship between category and magnitude scales. Furthermore, according to Montgomery, this relationship suggests that the category scale is a discrimination scale. Unfortunately, the assumption of a constant Weber function for category scales is often contradicted by empirical results. The standard deviations for category ratings are typically greatest in the middle and decrease toward both ends. Eisler and Montgomery (1974) suggested that this discrepancy between theory and empirical data could be explained in terms of bias or distortion in the Weber function of the category scale. Apparently, extreme stimuli are discriminated more easily than stimuli in the middle range. Clearly, additional data may be required to sort out the principles which determine the kind of relation to expect between category and magnitude scales.

Siegel and Pfeiffer (1966b) attempted to sort out this relationship. They factor analyzed the results of a set of category and magnitude scalings of technical job attributes. Full factorial congruency was not indicated. Siegel and Pfeiffer supported the use of the paired comparison method over the rank order and the magnitude estimation methods. It seems as if the judges in this study may have changed their frame of reference and differentially emphasized discrimination, boundary maintenance, and perceptual organizational aspects when employing these latter methods.

Eisler (1962, 1963) and Eisler and Montgomery (1974) summarized some opposing viewpoints concerning the relationship between magnitude and category scales.

One view, as proposed by Stevens (1957), is that the category scale is, in effect, a distorted magnitude scale. According to this view, subjects who make magnitude judgments are influenced by the variation in ease of discrimination at the low and the high ends of the scale. If ease of discrimination varies as a function of the position along the scale (low to high), then the function relating category to magnitude scales would likely be logarithmic. Thus, proponents of this view try to explain away any differences so that the threat to a single psychophysical law is eliminated. Stevens (1962) suggested that apparent departures from the basic law might lead to a new and deeper understanding of sensory metrics.

The opposing view regards the task of category rating as obviously different from the tasks of ratio or magnitude estimation. Emphasis is placed on the methodological differences inherent in the category and magnitude procedures. Proponents of this view suggest that the category situation yields a measure of the subjects' uncertainty whereas the magnitude method results in an estimate of subjective magnitude. Some of the variables given by other investigators to account for these differences have included size of subjective range (Engen & McBurney, 1964; Gibson & Tomko, 1972), spacing of stimuli (Pradham & Hoffman, 1963), the subjects' intent, ability to discriminate, and expectations (Stevens & Galanter, 1957), distortion of the Weber function (Eisler & Montgomery, 1974), and response bias (Schneider, Parker, Valenti, Farrell, & Kanow, 1978). According to Montgomery (1975), these scaling methods differ in four respects:

1. Rule of assignment of responses to subjective magnitudes. This factor denotes the instructions to judge subjective ratios in magnitude estimation versus the instructions to judge subjective differences (intervals) in category rating.

2. Openness of the response set. By openness is meant the degree of freedom given to the subject to choose a lowest and a highest number. In category rating there is usually no openness, whereas in magnitude estimation the choice of a lowest and a highest number is left to the subject.

3. Range of numbers. This factor denotes the range of numbers between the lowest and the highest number used by the subjects. Usually, the range of numbers used by the subject in magnitude estimation is much wider than the range of numbers used in typical category rating.

4. Discrete versus continuous set of numbers. In category rating, the subject is usually allowed to use only integers, whereas in magnitude estimation all positive, rational numbers are permitted.

The results of Montgomery (1975) showed that the form of a scale varies with: (a) the range of responses actually used by the subject, and (b) the subject's freedom of choosing a highest number as a response. The other factors that were investigated played only a minor role. A narrow range and fixed upper scale value yielded the typical category scale, whereas a wide range with no restriction on the highest value produced the typical magnitude scale.

Invariance When Scaling Job Requirements

A case in which the relationship between category and magnitude scales was found to be linear was demonstrated by Pfeiffer and Siegel (1966a). In their study, magnitude and category scaling methods were employed by journeyman electronics personnel to scale the apparent complexity of various aspects of their own job. The resultant data indicated that essentially equivalent scales were produced across the methods and that the continua of perceived complexity of four job activity stimuli and of 16 electronic circuit stimuli were metathetic. This latter conclusion was based on the relative homogeneity of interindividual discriminal dispersions for all the stimuli and also on the linear relation between the scales resulting from category and magnitude scaling procedures. The absence of large distortions as the result of the introduction of different methods suggested support for a single psychophysical law in the avionics job performance area. Studies supporting scale invariance of this general type have also been demonstrated in academic job areas. Pfeiffer (1970), drawing on techniques first developed at Applied Psychological Services, used both a magnitude estimation and a counting procedure to determine the requirements of college professors. American and European students and European professors were used as subjects. Correlations between these scales, ranging between .95 and .99, indicated strong linear relationships for all subject groups across scaling methods. The goodness of fit obtained by linear procedures in conjuntion with supportive data on uniform discriminal dispersions and the linear R-R relationships suggest a metathetic continuum for the range of values investigated. Moreover, the consistency of these investigations about the continuum of job complexity in the technical job areas presented suggest that this type of R-R scaling analysis of job complexity which included development of associated physical correlates could be done well in advance of the normal system development cycle and by subjects with diverse backgrounds (Siegel & Pfeiffer, 1966a). In the Siegel and Pfeiffer (1966a) study, the relationship between electronics job activity complexity, as perceived by maintenance technicians, and the scale value of these activities, as perceived by psychologists and physicists, was investigated. Guilford's Structure-of-Intellect Model(Guilford, 1967) was employed as referent. Magnitude estimation methods, based on the separate and independent judgments of technicians, physicists, and psychologists, were employed to derive the required data. Moderate to fairly strong relationships were found between the scale values of the intellective factors involved in the job activities and the perceived complexity of the activities for all subject groups.

Implications

The present review possesses a number of implications for the study which aims to investigate perceptual/psychomotor factors in Air Force specialties. The fact that psychological scaling may not always work perfectly should not be taken as *prima facie* evidence against the use or invariance of such scales in general. Many cases of scale invariance have been reported--particularly for metathetic continua (e.g., Ekman & Künnapas, 1963; Pfeiffer & Siegel, 1966b). However, the information on hand suggests that such scaling should be performed cautiously and that the sensitivity of the attribute being scaled to the type of scaling method should be determined prior to any major scaling endeavor. Such an investigation represents an early step in the present effort. If it is found that the scaling techniques are all, with minimal error, a linear function of one another, the selection of a scaling technique for employment can be based on considerations that are other than methodological. If the customary cost and time criteria are employed, a categorical or magnitude estimation method would appear superior. These methods yield values which can be used directly.

A persistently aggravating problem in scaling is posed by the fact that each judgment is affected by the other stimuli being judged. Pairwise ratio judgments and rankings seem most likely to show such effects. Unfortunately, context effects have also been shown to occur when category scales are employed (Cliff, 1973).

A strategy which has considerable historical support in scientific practice is to say that the preferred method is the one that is most direct. Magnitude and categorical scaling have this virtue. The only assumption is that the observer is able to carry out the instructions to quantify perceptions. Alternatively stated, this means that the subject reacts to number stimulation in the same way as to any stimulation.

Finally, one comforting fact is that, regardless of theoretic issues, psychological scaling of job tasks on attributes has been shown to yield useful, reliable data. In a study completed for the American Telephone and Telegraph Company (Siegel & Federman, 1976), a variety of craft and clerical tasks were rated by job incumbents on a number of taxonomic attributes. Adequate between-rater reliability was achieved and the data were able to provide a basis for job evaluative techniques.

III. METHOD DEVELOPMENT AND PRETEST

With the ability taxonomy described in Section II on hand, a method was sought that would allow application of the taxonomy to a range of Air Force career fields so as to determine whether each of these abilities is involved in the job performance of these career fields and if involved, the extent and influence of the involvement. Accordingly, some type of job analysis based on the derived taxonomy seemed indicated.

Methods of Job Analysis

Job analyses have been conducted, over the years, using a variety of data collection procedures. The relative desirability of the available methods depends on a number of factors. Perhaps the most important consideration is the goal of the analysis. At the general level, the goal of any job analysis is to derive information which describes what is done on the job, to develop information relative to the personal attributes required for job performance, or to derive a fuller understanding of the job itself. The derived information may be qualitative or quantitative; the information may be molecular or molar.

Direct Observation by Analysis

Job analytic data may be collected while the analyst is directly observing performance by job incumbents. This technique may appear optimal in that it affords the opportunity to question the job incumbent at any stage of the work. It allows photographs and physical and temporal measures to be taken as desired, and it may permit the analyst to perform some or all of the job. Data collected in this way are likely to be objective and accurate, since the method does not rely on the job incumbent's memory or expressive ability. Indeed, direct observation is often considered the superior method for collecting job analytic data (Yoder et al., 1958; Bechtoldt, 1951). However, the method is very costly in terms of analyst and job incumbent time, if all portions of a job are to be analyzed. The presence of the analyst may strongly influence the behavior of the worker, reducing the validity of collected data, and the results of applying the method can be influenced by the analyst's perceptivity. The technique may be applied only to analysis of a job which is currently being performed; actual equipment and sufficiently experienced personnel are required, as is the continued presence of a perceptive job analyst. Finally, the technique is suited to studies of the overt, observable aspects of job performance, but may not be effective for analyses of less observable, underlying variables associated with job performance such as are presently under consideration.

56

Interview Methods

Job analytic data are often collected through interviews with: single job incumbents, groups of job incumbents, or with others assumed to be expert with respect to the job of interest. The group interview approach is also sometimes called the technical conference technique. In interview techniques, data are generally collected away from the job site. The analyst will usually follow a structured or semistructured interview protocol. The goal of the interview may be to collect data descriptive of the job itself, or to collect data concerning some underlying variable or set of variables, such as required aptitude, skill, training requirements, or work pace. Interview techniques may be expected to be relatively inexpensive to apply, and they may yield a variety of job related data. Group interviews allow immediate review of data accuracy by the entire group, and the data may be collected by interview when the applicable equipment or facilities are unavailable or not in existence. On the negative side, accuracy and completeness of collected data are affected by the skill of the interviewer and the capabilities of interviewees to communicate. Data collected concerning time spent on tasks, levels of difficulty, skills required, etc., may be affected by subjective bias or imperfect memory on the part of the interviewee. Data obtained from supervisors or experts may tend to reflect expectations of those persons and the image they wish to present, rather than actual experience or behavior of job incumbents. Additionally, such data are likely to be colored by the range of skills and experiences held by the expert interviewee(s). The interview allows the acquisition of respondent insights beyond a simple categorical reply. It allows the respondents to elaborate more fully on their responses and to supply their own points of view. It also allows the interviewer to probe and to follow up on areas of doubt, concern, or ambiguity. Such an opportunity can only be minimally provided in other methods. However, the interview is an interpersonal interactive situation and, as such, is subject to the influence of such situations. Moreover, interviews are time consuming, and open-ended responses are subject to interpretive vagaries. The qualitative data emerging from interviews are often more difficult to treat and, if content analytic methods are involved, an additional error source may be introduced.

Questionnaires and Task Lists

Collection of job analytic data through questionnaires is appealing due to its economy in reaching a wide number of incumbents/supervisors. Very little time is required of the job analyst for collection of the data. However, the analyst has no control over and little idea of the attention or understanding applied in completing the questionnaire. As such, job analytic questionnaires are subject to the same biases as any questionnaire. The results may be biased by the wording of the set of questions employed or by their form. The response rate may be low and problems may arise in analyzing obtained data.

The task list approach is a variant of the questionnaire approach. In the task list approach to job analysis, a list of the tasks performed on the job is presented to the job incumbents or their supervisors. They are asked to complete a structured set of ratings relative to each task. The ratings may involve how frequently each task is performed, how hard it is to learn to perform each task, how serious the consequences of inadequate performance of each task are, how complex each task is, the length of time between training and performance of each task, how long it takes to perform each task, how important each task is, or whether or not each task is performed in an emergency.

The technique has received extensive investigation and application within the Air Force. The technique has also been adapted by at least one major business corporation, where it has been employed for training requirements and organizational structure development purposes (Siegel & Federman, 1976). The method has also been adapted for implementation on a commercial basis by at least one industrial consulting organization (Lopez, 1978).

Use of the method rests on the availability of a task list. The development of such a list depends on one or several of the job analytic methods just described. However, if such a list is available, the task list approach is comprehensive and economical, and the results are amenable to a variety of standard statistical manipulations. If the list is administered through the mail, there is little control over the quality of the responses, the diligence of the respondents, or the conditions under which the form is completed. However, if the lists are taken to the job incumbents, these problems may be avoided or controlled through orientational training, administrator diligence, and standardization of administrative conditions.

Daily Diary

In the daily diary approach to job analysis, workers are asked to keep detailed records of their daily activities. This method is inexpensive and may provide accurate data. The obtained data are usually in a form which is not readily amenable to statistical analysis. This method seems best suited only to determination of the tasks composing a job and the time devoted to each. Unless the workers complete the diaries during the course of their work, they may forget some details. And, completing such a diary during the course of the work may interfere with the work itself. Many blue collar workers do not feel at ease with this method because they are unaccustomed to any written expositional task.

Critical Incident

In the critical incident approach to job analysis, observers record or incumbents are asked to describe tasks or incidents which fall at the extremes of some continuum such as task performance time, degree of physical demand, or degree of risk. This technique is not useful for developing a detailed description of a job, factors underlying a job, or required abilities for job performance. However, the technique may provide a basis for recommendations for job modification or redesign, because the data elicited by the technique will direct attention to those aspects of a job which are extreme. The benefits and disadvantages generally applicable to interview and observation or questionnaire techniques of job analysis, as described above, apply when they are used within the critical incident approach.

Comparison of Various Approaches

The merit of each described job analytic procedure relative to various characteristics is summarized below:

	Cost	Interference with Work	Comprehensiveness	Accuracy	Quantitative Data	Objectivity	Applicability to Job Description	Applicability to Study of Underlying Abilities	Total
Direct Observation	-	-	+	+	0	+	+	-	+1
Interview Methods	-	+	+	-	-	-	+	+	0
Task List/Questionnaire	+	+	+	0	+	+	-	+	+5
Daily Diary	+	+	+	0	+	0	+	-	+4
Critical Incident	+	+	-	0	-	-	-	-	-3

The algebraic sums may be used to suggest roughly an order of merit for the various techniques. Of course, a technique must be selected with consideration given to the type of information desired, the goal(s) of the specific analysis, the information already available, and the constraints of the situation.

Task List Method

In the above analysis, the task list method appeared to be a preferred method of approach within the present study. The method received the highest absolute score. The task list method is highly applicable as a technique for deriving underlying abilities--a fundamental requirement of the present work. Moreover, the method was considered to be cost effective, would interfere minimally with ongoing work, and would be comprehensive, quantitative, and objective. Relative to the present program, the task list method seemed to possess the following advantages:

1. timeliness--the method seemed to allow achievement of the required goals within the required time period.
2. compatibility--the method is compatible with current Air Force practice.
3. balance--the method seemed to allow mutual consideration of all taxonomic categories with no category being unduly emphasized at the expense of other categories.

Discussion of Task List Method

The task list method of job analysis makes a few assumptions other than those normally assumed for any questionniare. Assuming an understandable task list and set of instructions, the method also assumes that the person completing the form is knowledgeable about the job and can accurately report that knowledge. Validity coefficients relative to reporting accuracy were found by Siegel and Musetti (1978) to be adequately high.

Anyone using an already developed list, must accept the comprehensiveness of the list and assume the job has not changed during the interval between initial list development and current application. Such lists also assume that the sequential ordering of the tasks is not a significant factor affecting the resultant data and that there is little, if any, sequence-by-rater interaction. Such an effect can, quite obviously, be balanced by rotation of the task list sequence across raters.

The task list approach has been employed by the Air Force in surveys of a number of task characteristics, including frequency of task performance, amount of supervision required or exercised, task complexity, training or knowledge requirements, relative task difficulty, experience required for effective performance, importance of task to unit mission, etc. (Morsh, 1964). The Air Force has found that task lists may be administered economically. According to Morsh, test-retest reliability of such lists administered by mail ranges around .70. Also, initial studies of validity show little disagreement between data provided by job incumbents and by their supervisors.

Within the Air Force context, Christal (1974) found the task list approach to job analysis to be economical, and to be highly quantifiable. Additionally, the approach is held to yield data which may be readily stored, manipulated, analyzed, and reported by computer, and are amenable to tests of validity and stability through standard statistical methods.

The method generally assumes that the rater will be free from bias. For example, a bias will result if a rater rates dishonestly. There may be raters who are openly dishonest or hostile to the rating procedure or job being evaluated. Alternatively, the rater may be uncommitted to the rating task. Campbell, Dunnette, Lawler, and Weick (1970) suggested that lack of rater commitment is the most serious source of rating bias. They reasoned:

> The most serious source of difficulty (bias) is a very fundamental one - stemming from a common tendency for psychologists to impose their own beliefs about job behavior and their own systems for recording it upon the persons whose task it is to observe that behavior . . . (It is) a lack of understanding and a lack of commitment to the observational (rating) task on the part of observers. As a consequence, they (the observers) tend to fill in the forms (job behavior rating scales) with little conviction; the records contain large and for the most part inestimable errors (p. 118-119).

Error due to lists provided and error due to the configuration of the ability structure selected represent stimulus error. There is no doubt that a stimulus task list, which is not objective, unambiguous, or complete or which otherwise does not incorporate the characteristics of a well-designed, coherent set of items, will be less than fully useful. However, there is a considerable amount of information available about how to construct such items, how to present them, and how to present clear instructions to the user. These sources of error were expected to be controlled in the present work by sufficient care and attention in task item writing and through clear rater instructions and training.

Similarly, the error introduced because of the configuration of the selected ability structure was to be reduced by providing a meaningful ability taxonomy and further reduced through an adequate set of definitions, examples, and instructions.

Pretest Sample and Task Sample

After the task list approach to data collection was tentatively selected, it had to be verified before employing it within a major data collection effort. Accordingly, a pretest was established. The specific goals of this pretest were as follows:

1. Identify problems inherent in the anticipated procedures, the instruments, and the measurement techniques.
2. Examine relationships between rater experience (i.e., supervisor versus subordinate ratings) and obtained information.
3. Assess the interrater reliability when employing the method.
4. Measure consistency of responses (test-retest reliability).
5. Serve as a test bed for determining time requirements.
6. Determine the sensitivity of the obtained data to various methods of scaling.

Pretest Sample

To accomplish the pretest, two career fields, Fire Protection (571XX) and Munitions Maintenance (461XX) were selected. The considerations behind the selection of these career fields were that a sufficient number of job incumbents seemed available at each of two air bases and that each career field represented a different aptitude area (as used by the Air Force for classification purposes). Fire Protection is classified in the general aptitude area, while Munitions Maintenance is a mechanical aptitude area specialty.

The job incumbents in the pretest were all assigned to Eglin and Homestead Air Force Bases. Supervisors, i.e., pay grades of E-6 or above, and subordinates, i.e., pay grades of E-5 and below, were sampled. Table 3-1 describes the sample by pay grade and career field.

Table 3-1

Description of Pretest Sample

Career Field	Pay Grade E-5 or Below	 E-6 or Above	Total
Fire Protection (571XX)	24	23	47
Munitions Maintenance (461XX)	22	24	46
Total	46	47	93

Task Sample

In an effort to develop pretest task lists that were fully representative of the tasks and duties performed by the personnel in the two career fields, Air Force Occupational Survey Reports (OSRs) were consulted, and tasks were selected in accordance with the following task/duty* sampling scheme:

1. Eliminate tasks and duties involving only supervision, planning, and training.
2. Eliminate duties performed only by 25 percent or less of the members of a career field.
3. Establish a target list length of 20 tasks for each career field. Weight the duties in each career field in accordance with the following weighting scheme:

% Performing	Weight
75 or more	4
Between 50 and 74	3
Between 26 and 49	2

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* A duty is a set of related tasks. Tasks are grouped under duties in an OSR.

> Sum the weights over the duties included and calculate the ratio of the weighted sum in each category to total task sample size, e.g., if the sum of weights over all duties is 20 and there are two duties with weights of four, then 40 percent of the total number of tasks selected would be drawn from the duties with the weight of four (4 + 4 = 8; 8/20 = 40%). If the calculation results in a fraction, add a task to the duty with the largest number of tasks, within the group of duties with the same weight.

Table 3-2 presents the results of the sampling procedure for the two pretest career fields.

Development of Forms

A set of data collection forms was developed to allow the collection of information about the involvement of each of the 13 perceptual/psychomotor abilities in each task. The forms were prepared separately for each career field but the forms for the two career fields were similar in format. Each form contained a full set of instructions and examples of how to complete the form.

Perceptual/Psychomotor Abilities

The 13 abilities contained in the perceptual/psychomotor ability taxonomy were prepared for employment in the pretest. Several modifications were introduced into the prior definitions in order to make them more meaningful to the anticipated job incumbent raters. Additionally, examples of activities involving each ability were developed for each definition. For each ability, two examples were developed to typify tasks in which a "high" amount of the ability is required, and two other examples of activities were developed for which a "low" amount of the ability is required. The perceptual/psychomotor ability definitions list used in the pretest, along with the examples, follows:

1. Finger Dexterity (FD)--skillful, coordinated, precise finger movements that involve the use of one or more fingers to achieve quick and accurate manipulation, insertion, or grasping of small objects.

   Examples:

   High 1. Typing requires rapid movement of several fingers to perform a sustained, coordinated activity.

Table 3-2

Task Sampling Procedures for Pretest Career Fields

Munitions Maintenance (461XX)

Duty Sample	% Performing	Weight *	No. of Tasks **
C	95	4	3
E	91	4	3
F	49	2	2
G	27	2	1
H	67	3	3
I	64	3	3
J	33	2	1
M	60	3	2
N	48	2	2
		Σ = 25	

* Ratio of weight to sample size; 4: 8/25 = 32%, 3: 9/25 = 36%, 2: 8/25 = 32%

** Number of tasks to be sampled from each weighted category; 4: 32% x 20 = 6, 3: 36% x 20 = 8, 2: 32% x 20 = 6

Fire Protection (571XX)

Duty Sample	% Performing	Weight *	No. of Tasks **
C+	37	2	-
E	62	3	1
F	83	4	2
G	55	3	1
H	53	3	1
I	63	3	1
J	71	3	2
K	71	3	2
L	70	3	2
M	66	3	1
N	79	4	1
O	82	4	2
P	30	2	1
Q	47	2	1
R+	28	2	-
S	35	2	2
		Σ = 46	

+ The OSRs did not contain task related data for Duties C and R due to very low percentage data. Replacement tasks were selected from other duties in the same weight category (Duty Q, by this procedure, should have had two tasks sampled but the OSR reported only one task)

* Ratio of weights to sample size; 4: 12/46 = 26%, 3: 24/46 = 52%, 2: 10/46 = 22%

** Number of tasks to be sampled from each weighted category; 4: 26% x 20 = 5, 3: 52% x 20 = 11, 2: 22% x 20 = 4

2. Painting, drawing, and lettering require the accurate manipulation of an implement.

Low

1. Pulling the trigger on a revolver requires little finger dexterity because only one finger is used in a relatively uncoordinated action.
2. Activating a light switch is low on finger dexterity because only a finger and thumb (or finger alone) are used to throw the switch and no precision is required to position the switch.

2. Manual Dexterity (MD)--skillful, well-directed, coordinated arm and hand movements to manipulate objects quickly and accurately (but, not controlling a machine).

Examples:

High

1. Assembling a radio because parts and tools must be manipulated accurately, carefully, and in a coordinated manner.
2. Welding a patch in an aircraft's skin requires a high degree of skillful arm and hand manipulation.

Low

1. Closing a door is low in manual dexterity because there is little directed activity or coordination involved.
2. Grasping pliers to hold an object requires some manual dexterity, but little skilled movements or coordination of the arm and hand.

3. Control Precision (CP)--rapid, precise adjustments by an arm, hand, (individually or simultaneously) to a machine's control mechanism (e.g., levers, pedals). The adjustments do not involve objects (e.g., pencils, tools, electronic parts).

Examples:

High

1. Fine-tuning a radio dial requires control precision.
2. Manipulating the gas pedal in an automobile requires control precision because a car is highly sensitive to slight changes in the pressure applied.

Low 1. Operating an on-off switch requires minimum precision in going from one position to the other.

2. Activating the high beam lights of a car with the foot control requires a low level since it is accomplished with a single depression and no adjustments or precision are required.

4. Rate Control (Tracking) (RC)--continuous and accurate arm, hand, or leg control adjustments to changes in the speed and/or direction of continuously moving objects. The purpose is to intercept, control, or follow a moving object.

Examples:

High 1. Tracking a target on a cathode ray tube (CRT) by keeping the target inside a cursor (circle) requires fine control adjustments to quickly moving targets that move in several dimensions.

2. Auto driving requires continuous within-tolerance adjustments of the steering wheel.

Low 1. Illuminating a slowly moving object with a flashlight requires little rate control because the speed of movement is low and the performance tolerances are high.

2. Walking with others requires a low amount because speed will vary slightly and the movement is in a readily predictable direction.

5. Visual Memory (VM)--recall of things which have been seen in the past and expressing the recalled visual information.

Examples:

High 1. Identifying a needed spare part in a group of parts on the basis of appearance requires the ability to recognize the spare part and specify it by name and/or number.

2. Recalling the appearance of a given aircraft type requires memory for visual information.

Low 1. Entering parts replaced on a maintenance form requires a low level because the appearance of the parts does not have to be remembered or expressed.

2. Scheduling work assignments requires a low level because the appearance of the persons to be assigned does not have to be remembered.

6. Visual Speed and Accuracy (VSA)--seeing small, fine details quickly and accurately. It includes seeing differences in size and shape.

Examples:

High

1. Inspecting a part for rust, chips, mars, scratches, or marks requires the ability to see fine details quickly. No recall is involved.
2. Examining and separating fingerprints quickly requires the ability to distinguish size and shape of fine details in a limited time period.

Low

1. Washing an aircraft because the visual actions to be performed are quite gross.
2. Inspecting cargo for shipping size restrictions requires a low amount because the details are gross and few time restrictions exist.

7. Position Memory (PM)--recalling rapidly and accurately the position of objects from past experience. Emphasis is on recalling the position or location of where objects belong without having to express it.

Examples:

High

1. Performing a preflight inspection because the location of the items to be inspected must be recalled.
2. Locating a part in an aircraft as the result of a prior experience with the part.

Low

1. Fueling an aircraft because the fueling points are quite obvious.
2. Filing requires a low level of position memory because the alphabetical sequencing is obvious.

8. Auditory Discrimination (AD)--distinguishing sounds and interpreting them.

   Examples:

   High
   1. Detecting and determining a malfunction in a motor on the basis of the sounds of the motor.
   2. Interpreting Morse code.

   Low
   1. Listening to a pipe to determine if water is flowing through it involves a low level of auditory discrimination because the sound is distinctive and the discrimination is gross.
   2. Determining whether or not a motor is running requires a low level since there are only two choices, on or off, and the sound of a running motor is quite identifiable.

9. Auditory Memory (AM)--remembering, recognizing, and reproducing the characteristics of sounds. This ability does not involve interpretation of the sounds.

   Examples:

   High
   1. Recognizing a navigational tone in the presence of conflicting signals and describing the sounds verbally.
   2. Explaining the characteristics and distinguishing features of an emergency signal.

   Low
   1. Describing radio static on a maintenance form.
   2. Identifying thunder during an electrical storm.

10. Clerical Perception (CLP)--rapid and accurate reading or copying of details in scales, graphs, charts, or tables.

   Examples:

   High
   1. Copying a long list of numbers from a telephone directory.
   2. Obtaining information from a detailed parts replacement stock list requires a high level.

Low
1. Standing guard duty at the base entrance and noting numbers from automobile license plates.
2. Reading organizational charts.

11. Depth Perception (DP)--determining positional relationships among objects in space.

    Examples:

    High
    1. Operating an aircraft in a congested area requires a high amount due to the involved arrangement of the aircraft in space.
    2. Flying in formation

    Low
    1. Loading an aircraft with cargo.
    2. Attaching an auxiliary power unit (APU) to an aircraft.

12. Divided Attention (DA)--receiving and using information from more than one source at the same time.

    Examples:

    High
    1. Monitoring and directing aircraft in the control tower based on information received from the radio and the radar requires a high level because of the simultaneous use and integration of complex information from more than one channel.
    2. Flying an aircraft under instrument flight regulations (IFR) conditions because various instruments must be read, a radio must be monitored, and the aircraft controlled at the same time.

    Low
    1. Testing an electronic equipment on the basis of a meter and a sound signal requires a low level because although two channels are involved, the operator can shift easily from one to the other.
    2. Supervising several subordinates requires a low level because the supervisor is not dependent on receiving the information simultaneously.

13. Kinesthetic Memory (KM)--manipulating objects without benefit of visual guides or indications.

Examples:

High	1.	Replacing screws in places that are not in sight, such as under a dashboard, requires a high amount of the ability since the actions cannot be observed and a blind positioning action is involved.
	2.	Attaching a fitting to the pipe under a sink requires a high level because visual guides are not available during the manipulations.
Low	1.	Screwing a light bulb into a socket in a dark room requires a low amount of kinesthetic memory because the relationship is quite obvious.
	2.	Inserting a key into a keyhole in a dark room requires a low amount because the manipulation of the object is limited. Only an insertion is involved.

Perceptual/Psychomotor Ability Requirements Questionnaires

To provide a basis for achieving the overall pretest goals--evaluation of the task list questionnaire method of data acquisition and the utility of the taxonomy--two data types were relied on: (a) how much each ability is involved in the performance of each task (amount) and (b) the variability in the quality of task performance as a function of each specific ability (performance quality variability). The first data type provides a measure of the relative saturation of a perceptual/psychomotor ability in the performance of a task, and by summary in the performance of the career field. The second data type provides an indication of whether or not the ability separates good from poor task performers.

Each data collection instrument was divided into two sections. The first was called "Amount of Perceptual/Psychomotor Ability"; the other was titled "Performance Quality Variability as a Function of Perceptual/Psychomotor Ability."

Each section was further divided into two parts--one part required a categorical response while the second required a magnitude estimation. The survey respondents, thereby, yielded an evaluation of each task twice in each section of the form--once using a category scale and again using a magnitude estimation scale.

For the categorical estimations, a five-point category scale was used. The range of categories, in the amount section, was from "1" (very little) through "5" (very much), with the scale value of "3" (moderate) anchoring the midpoint. The scale appeared on a card which the respondents referred to while completing the form and also in the appropriate set of instructions. Two other qualitative responses were included: N = not performed in your squadron and NR = performed, but ability not required in task performance.

The magnitude estimation scale provided greater freedom of response. The scale ranged from 0 to 100, and allowed the option of selecting any intermediate value. Qualitative descriptive anchors were placed under the scale of values at five levels. The instructions to the two sections and the two parts within each section of each questionnaire are presented in Appendix A to this report.

Pretest Administration

An Applied Psychological Services staff member, who was involved in their preparation, administered the forms at the two Air Force bases involved. The survey sessions were conducted in classroom situations. About 12 to 25 respondents participated in each data collection session.

The person who performed the form administration was experienced in data collection techniques in the military and was knowledgeable of the perceptual/psychomotor taxonomy and the job analytic concepts.

Administrator's Training

A set of administrator instructions was prepared for and reviewed by the administrator prior to his air base visits. The instructions presented a standardized procedure for the administration. All pertinent procedural steps were outlined in the instructions. This allowed the administration to proceed in a consistent manner across sessions.

The administrator instructions suggested the points to cover in a briefing period which preceded the respondents' completion of the forms. Additionally, the instructions suggested an administrative style and attitude which would be both helpful and motivating to the respondents.

73

Administrator Instructions

1. Assemble the group
2. Distribute the following
    - forms by AFSC number (right corner of cover page)
    - definitions list
    - pencils
3. Introduction
    - your name
    - give company name and geographic location
    - indicate that Applied Psychological Services is under contract to the Air Force Human Resources Laboratory, Brooks Air Force Base, to conduct this research program
4. Purpose of research program
    - to evaluate the abilities required in different Air Force jobs (i.e., the sensory and manipulative aspects of the job, the things people do, and the performance aspects of the job)
    - the data will be used specifically to help the Air Force determine job performance requirements
    - the global purpose is to improve the entire career development program in the Air Force
5. Why respondents were chosen for the study
    - the best way to obtain the needed information is to come directly to the people who are most knowledgeable about the jobs, namely, you the job holder
    - you were chosen because, due to your job knowledge, your opinions of the amount of involvement of each skill in the performance of various tasks and the difference in the quality of performance (as a function of each ability) will be more valid than the opinions of people who are not as involved in the specialty
6. Explain the respondent's task
    - there are 13 abilities that we are interested in
    - the abilities, which are defined in the definitions list you were given, appear across the top of the form (demonstrate)

- there are a total of 60 tasks, 20 on each of these pages--the tasks appear vertically down the left side of each page (demonstrate).

- the tasks appearing in the form represent a small sample of the tasks done on the job. They were obtained from the Occupational Survey Reports (OSRs) of each career field.

- there are two sections in the form. In the first section, you are asked to give your opinion of how much you think each ability is involved in the performance of each task. In the second section, you are asked to judge how the quality of performance amoung job incumbents varies as a function of each ability. Each section has a set of instructions and examples which will explain the purpose and method of responding.

- since this is a pretest of the survey forms and one purpose is to find out which one scale, of two different types, will be better to use, you will be asked to make the same evaluations twice in each section. One of the scales, which is called a category scale (demonstrate) has values from 1 to 5. Enter the value that best describes your opinion. If a task is not performed in your squadron, then you would enter "N" in the appropriate box (demonstrate). If you are of the opinion that a particular skill is not required in the performance of a task, then you enter "NR" in the appropriate box (demonstrate). The other scale you will use is called a magnitude estimation scale (demonstrate). In using this scale, you may select any value from zero to 100 that best describes your opinion. Make every effort to enter a judgment, even if you don't perform the task yourself and never did. We are not interested in what you personally do on the job--only in what you know about the performance of the tasks on the list. Your knowledge of these tasks could have come from your training, observation, or past performance. Try to respond in every instance with a scale value. There are scale cards attached to every booklet. Remove these cards and keep them in front of you as you make your judgments.

- to make your task easier, fill in one column at a time. Start with the first skill, (demonstrate) finger dexterity (FD) and fill in that entire column starting with task 1 and continue until you have finished the last task in the column. Before you start filling in the scale values, read the definition for the first skill and keep the definion list in front of you, so that you can refer to it whenever necessary. After you finish the first column, read the definition of the second skill and complete the second column. If you complete the form in this manner, you will not have to remember the definitions of all of the skills at one time.

- after you complete each section of the form, go right on to the next. Make sure that every box has a response in it. Do not leave any blank boxes.
- fill in the information called for on the cover page. None of the information you provide will be reported by your name. We request your name for administrative purposes only. The data collected will be grouped and treated statistically. All information provided is used for research purposes only and is held strictly confidential.
- if you have any questions, feel free to ask at any time.

7. During the administration, pass among the respondents and make sure that the forms are being completed in a downward sequence on the page and that each respondent is referring to the proper definition for the column being completed.
8. Maintain an informal and friendly atmosphere so that a rapport between the administrator and the respondents is developed.
9. Make extra pencils available to the respondents, as needed.
10. Go over the forms when they are turned in to assure that there are no blanks, glaring errors, or obvious inconsistencies. If any are detected, ask the respondent to review the form.

Personal Interview

A semistructured personal interview was conducted with a sample of the respondents in order to

1. provide an opportunity to acquire retest data for a test-retest reliability determination.
2. obtain evaluations of the appropriateness of the perceptual/psychomotor abilities included in the taxonomy.
3. obtain respondent reaction to the two scaling techniques.
4. acquire opinions on methods for improving the data collection instruments

The full interview is presented in Appendix B to this report.

Interviewer Instructions

The administrator of the survey forms also served as the interviewer. All interviews were conducted in private and by scheduled appointment, on the day following the completion of the forms. The instructions provided to the interviewer are presented below.

Interviewer Instructions

1. Conduct the interview in a quiet place, free from traffic and excessive interference.
2. Introduce yourself and Applied Psychological Services.
3. Explain that the interview was designed to obtain opinions about the questionnaire forms and also to obtain additional information about the amount and performance quality variability levels of the various perceptual/psychomotor abilities involved in the tasks performed in the individual's career field. State the following:

   > I have a short interview which will, in part, be based on the form you completed. Your answers will be held confidential. The data will be treated statistically and your name will not be associated with it in any way.

4. Conduct the interview in a friendly and informal manner. This interview is not a test, but a fact finding and opinion searching activity. Do not be critical, approving, or disapproving. Listen carefully to all comments; be attentive and supportive at all times.
5. Complete the general information called for on the interview form before starting the interview.
6. Ask the questions as they are worded, since standardization across all respondents is sought. Do not omit any portion of a question, or add a comment that is not included. Read the questions slowly and clearly and in the same order in which they appear in the form. Present the interviewee with the card of options, wherever indicated on the interview form. Repeat a question that was misunderstood or misinterpreted; do not rephrase or reword the question. If the respondent needs additional time to think of a response, allow it.
7. Provide the respondent with positive feedback whenever possible by nodding your head, or passing neutral comments such as "yes," "okay," or "I see."
8. If a response is incomplete or irrelevant, probe for a more acceptable response. This may be accomplished by repeating the question or the response. Other effective probes are to ask if there is "anything else," "how so," or "can you explain that to me."

9. Record responses in the spaces provided on the interview form at the time the responses are provided.
10. It is important that the interviewee understands the polarity of the rating scales. For example, zero means very unimportant or very easy.
11. Answer all questions in a neutral manner. Terminate the interview by thanking the individual for cooperating.

Interview Sample

Twenty-four interviews were conducted--12 representing job incumbents in each of the two career fields. In each career field, six supervisors and six subordinates were interviewed. Every supervisor, in both career fields, had served in that career field and in the Air Force for over five years. The subordinates who were interviewed were somewhat less experienced than their supervisor counterparts. As a group, they were equally divided in their career field experience. Approximately one-half had served three to five years and the other half had served more than five years in their career field.

Results--Quantitative

A set of data analyses was completed in order to determine the utility of the methods and taxonomy. These analyses sought

1. To establish the ability of the 13 taxonomic classes to differentiate among tasks.
2. To examine the relationship between the supervisory and the subordinate perceptions of job perceptual/psychomotor skill influences.
3. To examine the relationship between the amount of the abilities required in the performance of the tasks and the performance quality variability.
4. To develop profiles of perceptual/psychomotor abilities for each specialty.
5. To determine the relationship between the categorical and the magnitude estimation judgments and the nature of the underlying scale of each.
6. To evaluate interrater agreements.
7. To obtain measures of test-retest reliability.

Discrimination--Taxonomic Classes--Fire Protection Career Field

To obtain information about the ability of the taxonomic classes to discriminate, measures of central tendency were calculated for the 13 perceptual/psychomotor abilities. For the Fire Protection (571XX) career field, these were calculated separately for the supervisory raters and subordinate raters, for both scaling techniques, as well as for the amount and performance quality variability judgments. The results are presented in Table 3-3.

The mean data for the categorical scale evaluations of the Fire Protection career field indicated, at best, only a moderate range across the 13 taxonomic classes. The range of the mean value for the supervisors was 1.9 to 3.4, while the range for the subordinates was 2.4 to 3.3. The midpoint of these values was approximately 2.9, in both cases. These ranges seem somewhat restricted. The standard deviations around the means showed reasonable spread for each taxonomic class. The standard deviations ranged from 1.2 to 1.6 and 1.4 to 1.7, for the supervisors and subordinates, respectively.

For the magnitude estimation method in the Fire Protection career field (Table 3-3), the range of mean values for the 13 abilities was 28 to 53 for the amount judgments of the supervisors (with a spread of standard deviations ranging from 25 to 38) and from 38 to 55 (with standard deviations ranging from 26 to 32) for the judgments by subordinates. Again, these ranges seem somewhat restricted. As with the categorical scale, the approximate midpoint of the evaluations was at the low end of the "moderate" portion of the magnitude estimation scale (43 for the supervisor group and 46 for the subordinates).

The data for the performance quality variability indicated a lesser spread of mean data and standard deviations, as well as a consistently lower set of scale value selections than the amount data. Table 3-3 indicates a range of mean data on the categorical scale judgments, across the 13 abilities, of 1.7 to 2.5 (with standard deviations ranging from 1.2 to 1.4) and 2.2 to 2.6 (with standard deviations ranging from 1.3 to 1.5) for the supervisors and subordinates, respectively. Similarly, the performance quality variability magnitude estimation scale judgments indicated less spread than the amount judgments and lower scale choices, e.g., a range of 26 to 45 for the supervisors (with a standard deviation range from 26 to 31) and 35 to 45 for the subordinates (with a standard deviation range from 27 to 41).

While the mean scale values for amount and for performance quality variability were distributed in close proximity, making it

Table 3-3

Perceptual/Psychomotor Ability Means and Standard Deviations for the Fire Protection Career Field

Categorical Scale

Perceptual/ Psychomotor Ability	Amount				Performance Quality Variability			
	Supervisor		Subordinate		Supervisor		Subordinate	
	M	σ	M	σ	M	σ	M	σ
FD	2.7	1.4	2.8	1.4	2.2	1.3	2.2	1.3
MD	3.1	1.5	3.2	1.4	2.5	1.4	2.5	1.4
CP	3.1	1.5	2.9	1.5	2.4	1.4	2.4	1.3
RC	3.1	1.6	2.7	1.6	2.4	1.4	2.3	1.4
VM	3.4	1.4	3.1	1.4	2.3	1.3	2.6	1.4
VSA	2.9	1.5	3.0	1.5	2.4	1.3	2.3	1.3
PM	3.1	1.5	3.3	1.5	2.3	1.3	2.6	1.4
AD	2.5	1.5	2.9	1.5	2.2	1.4	2.4	1.4
AM	2.5	1.5	2.7	1.5	2.2	1.4	2.6	1.3
CLP	1.9	1.2	2.4	1.5	1.7	1.2	2.5	1.5
DP	2.7	1.6	2.9	1.7	2.2	1.4	2.5	1.4
DA	2.6	1.5	2.7	1.5	2.1	1.3	2.4	1.3
KM	2.3	1.4	2.4	1.5	2.0	1.3	2.5	1.4

Magnitude Estimation Scale

Perceptual/ Psychomotor Ability	Amount				Performance Quality Variability			
	Supervisor		Subordinate		Supervisor		Subordinate	
	M	σ	M	σ	M	σ	M	σ
FD	42.8	30.1	46.5	27.1	37.7	29.8	35.4	28.0
MD	50.8	31.3	55.1	26.1	41.5	29.5	39.0	29.4
CP	47.6	31.3	50.5	29.0	41.1	29.0	40.4	29.2
RC	45.0	33.3	45.7	30.9	42.3	30.5	43.6	29.1
VM	49.8	30.1	49.4	29.9	44.8	30.7	41.0	29.4
VSA	49.8	36.9	48.6	31.9	39.6	30.1	40.7	29.7
PM	52.8	35.7	52.3	31.3	45.1	30.4	43.8	29.2
AD	41.7	38.1	46.8	30.6	35.3	29.2	42.3	28.9
AM	42.3	31.1	44.1	29.5	33.9	29.9	42.1	40.9
CLP	28.2	25.0	38.1	28.2	26.3	27.3	42.3	31.3
DP	40.6	32.2	47.1	29.9	33.5	28.8	41.8	29.7
DA	37.2	28.7	44.2	28.3	33.9	25.6	37.7	27.2
KM	37.9	29.5	44.7	30.5	30.6	26.9	44.5	29.5

difficult to separate the perceptual/psychomotor abilities into high and low groups, an arrangement into high and low groups of abilities was possible in each case. The mean scale values for the abilities were hierarchically arranged (from high to low) and lines of demarcation were drawn between the largest gaps, separating the abilities into high and low groups (on each scale). The results are as follows:

Amount

	Categorical Scale	Magnitude Estimation Scale
High:		
Supervisors	Manual Dexterity Control Precision Rate Control Visual Memory Position Memory	Manual Dexterity Visual Memory Visual Speed and Accuracy Position Memory
Subordinates	Manual Dexterity Visual Memory Visual Speed and Accuracy Position Memory	Manual Dexterity Control Precision Position Memory
Low:		
Supervisors	Clerical Perception Kinesthetic Memory	Clerical Perception
Subordinates	Clerical Perception Kinesthetic Memory	Clerical Perception

Performance Quality Variability

	Categorical Scale	Magnitude Estimation Scale
High:		
Supervisors	Manual Dexterity Control Precision Rate Control Visual Speed and Accuracy	Visual Memory Position Memory
Subordinates	Visual Memory Position Memory Auditory Memory	Rate Control Position Memory Kinesthetic Memory

Low:

Supervisors	Clerical Perception	Clerical Perception
Subordinates	Finger Dexterity	Finger Dexterity

This suggests that, in spite of the somewhat restricted range yielded by the taxonomy and scales, some separation can be achieved. Moreover, the "high" and the "low" results seem to make sense in terms of what is generally known about the duties of the Fire Protection career field.

Discrimination--Taxonomic Classes--Munitions Maintenance Career Field

Table 3-4 presents the 13 taxonomic class means and standard deviations for both the categorical and magnitude estimation scale judgments for the Munitions Maintenance career field. The range for the supervisors on the categorical scale, for the amount judgments, was from 1.4 to 2.9 (with a range of standard deviations from 0.9 to 1.5) and the range for the subordinates was from 1.3 to 2.9 (with a range of standard deviations from 0.8 to 1.6). On the magnitude estimation scale, the range of means for the supervisors was from 15 to 40 and it was from 24 to 48 for the subordinates. The standard deviations, for the respective groups ranged from 15 to 30 and from 22 to 57. Again, the somewhat restricted range of the responses is evident.

For quality variability and the categorical scale, the range of mean judgments was from 1.6 to 2.1 for the supervisors and from 1.7 to 2.1 for the subordinates. The standard deviations were again reasonable and ranged from 0.9 to 1.2 for the supervisors and from 1.2 to 1.5 for the subordinates. The magnitude estimation scale produced the following range of mean data for quality variability: 22 to 30 for the supervisors and 18 to 31 for the subordinates. The range of standard deviations for the supervisors was from 19 to 25 for the supervisors and it was from 19 to 28 for the subordinates.

The distribution of mean judgments over the 13 abilities was again such that lines of demarcation could be readily interposed on a distribution of the values, forming meaningful relative groups of "high" and "low" abilities. Such a result, at least partially, supports the discriminating power of the methods employed.

Table 3-4

Ability Means and Standard Deviations for the Munitions Maintenance Career Field

Categorical Scale

Perceptual/ Psychomotor Ability	Amount				Performance Quality Variability			
	Supervisor		Subordinate		Supervisor		Subordinate	
	M	σ	M	σ	M	σ	M	σ
FD	2.0	1.1	2.3	1.4	1.8	1.2	1.9	1.3
MD	2.3	1.4	2.5	1.5	1.8	1.1	1.9	1.3
CP	2.1	1.4	2.0	1.4	1.8	1.2	1.8	1.2
RC	1.8	1.3	2.0	1.5	1.7	1.1	1.7	1.2
VM	2.9	1.5	2.9	1.5	2.1	1.2	2.1	1.3
VSA	2.6	1.5	2.7	1.6	2.1	1.2	2.0	1.3
PM	2.6	1.5	2.7	1.5	1.9	1.2	2.1	1.4
AD	2.0	1.4	2.2	1.5	1.7	1.2	1.9	1.4
AM	1.8	1.2	1.9	1.4	1.6	1.2	1.9	1.5
CLP	2.3	1.5	2.6	1.5	1.8	1.1	2.0	1.4
DP	1.9	1.3	2.2	1.5	1.7	1.1	1.9	1.4
DA	1.8	1.2	2.2	1.4	1.6	0.9	1.8	1.2
KM	1.4	0.9	1.3	0.8	1.6	1.1	1.8	1.4

Magnitude Estimation Scale

Perceptual/ Psychomotor Ability	Amount				Performance Quality Variability			
	Supervisor		Subordinate		Supervisor		Subordinate	
	M	σ	M	σ	M	σ	M	σ
FD	25.4	20.8	30.7	23.7	22.3	20.8	26.5	23.5
MD	33.8	27.7	38.2	28.1	24.1	21.0	30.5	27.4
CP	31.2	27.6	29.9	27.4	25.0	22.3	26.9	24.8
RC	23.9	25.3	29.3	28.0	23.3	22.7	26.2	24.2
VM	39.7	28.4	45.6	30.0	29.6	23.0	30.9	25.4
VSA	37.5	29.7	46.1	56.7	28.5	22.6	30.4	27.0
PM	38.8	29.1	47.6	29.6	26.9	23.0	30.9	26.3
AD	26.9	27.1	33.9	30.0	24.9	22.4	26.2	23.5
AM	25.3	26.2	30.4	28.8	23.1	22.0	30.4	27.6
CLP	33.2	27.5	40.3	30.5	24.3	21.5	27.0	23.2
DP	30.0	28.4	39.4	30.7	22.6	21.1	24.7	24.1
DA	26.1	27.2	37.3	29.5	24.0	24.6	23.5	21.5
KM	15.2	15.1	23.5	21.5	21.5	19.2	18.2	19.4

Amount

	Categorical Scale	Magnitude Estimation Scale
High:		
Supervisors	Visual Memory Visual Speed and Accuracy Position Memory	Visual Memory Visual Speed and Accuracy Position Memory
Subordinates	Manual Dexterity Visual Memory Visual Speed and Accuracy Position Memory Clerical Perception	Visual Memory Visual Speed and Accuracy Position Memory
Low:		
Supervisors	Kinesthetic Memory	Kinesthetic Memory
Subordinates	Kinesthetic Memory	Kinesthetic Memory

Performance Quality Variability

	Categorical Scale	Magnitude Estimation Scale
High:		
Supervisors	Visual Memory Visual Speed and Accuracy	Visual Memory Visual Speed and Accuracy
Subordinates	Visual Memory Visual Speed and Accuracy Position Memory Clerical Perception	Manual Dexterity Visual Memory Position Memory
Low:		
Supervisors	Auditory Memory Divided Attention Kinesthetic Memory	Finger Dexterity Kinesthetic Memory
Subordinates	Rate Control	Kinesthetic Memory

Discrimination--Tasks--Fire Protection

In a similar vein, the means and standard deviations for the 20 tasks (for amount and performance quality variability) on each scale were calculated for the Fire Protection specialty. These appear in Table 3-5. The two sets of mean data, supervisor and subordinate respectively, for amount on the categorical scale ranged from 1.7 to 3.8 and from 2.0 to 3.9. This result seems more acceptable than that indicated for the taxonomic classes. The standard deviations for these mean data was entirely acceptable--1.1 to 1.6 for the supervisor group and from 1.3 to 1.6 for the subordinate group. The magnitude estimation scale data indicated similar results for the amount date (Table 3-5). The range of mean data for the tasks, for amount, ranged from 24 to 63 for the supervisors (with a standard deviation range of 21 to 52); the range for the subordinates was from 30 to 69 (with a standard deviation range of 24 to 31).

For the performance quality variability data (Table 3-5), the supervisors' range of mean amount judgments on the categorical scale was 1.4 to 3.1; the range for the subordinates was 1.8 to 3.7. These ranges are again broader than for the parallel analysis in which taxonomic classes were considered across tasks. The respective ranges of standard deviations were 0.8 to 1.5 and 1.2 to 1.4. On the magnitude estimation scale, the range of performance quality variability means for supervisors across the 20 tasks, was 23 to 57 (with a standard deviation range from 21 to 31). The range for subordinates, on the same scale, was 32 to 65 (with a standard deviation range from 25 to 48).

Accordingly, the restricted range patterns seen for the individual taxonomic classes was somewhat broken for the task data.

Discrimination--Tasks--Munitions Maintenance

Table 3-6 presents the means and standard deviations for the amount and performance quality variability judgments, on both scales, for each group of Munitions Maintenance judges. The range of the amount judgments, for supervisors and subordinates, on the categorical scale was 1.7 to 3.1 and 1.8 to 3.2, respectively. These ranges seem quite acceptable and are greater than the corresponding ranges for the taxonomic class data. The range of standard deviations for the supervisors was 1.0 to 1.7 and 1.1 to 1.7 for the subordinates. The range on the magnitude estimation scale for supervisors was 19 to 53 (with a standard deviation range from 16 to 33); the range for subordinates was 25 to 54 (with a range of standard deviations from 22 to 71). These values, too, are considerably greater than for the taxonomic class data. The mean categorical

Table 3-5

Task Means and Standard Deviations Across Abilities for the Fire Protection Career Field

Categorical Scale

	Amount				Performance Quality Variability			
	Supervisor		Subordinate		Supervisor		Subordinate	
Task	M	σ	M	σ	M	σ	M	σ
1	3.8	1.4	3.9	1.4	3.1	1.5	3.7	1.4
2	2.5	1.4	2.6	1.5	2.0	1.1	2.5	1.4
3	1.7	1.1	2.0	1.3	1.4	0.8	2.0	1.3
4	3.4	1.4	3.3	1.5	2.3	1.2	2.5	1.4
5	2.7	1.5	2.7	1.5	2.2	1.2	2.4	1.4
6	2.6	1.4	2.6	1.4	2.0	1.2	2.1	1.2
7	3.4	1.5	3.2	1.5	2.6	1.4	2.8	1.4
8	3.3	1.6	2.9	1.5	2.7	1.5	2.4	1.4
9	3.1	1.5	3.0	1.5	2.7	1.5	2.6	1.4
10	3.3	1.5	3.0	1.4	2.4	1.4	2.5	1.2
11	3.1	1.5	3.1	1.4	2.4	1.4	2.6	1.3
12	3.4	1.4	3.0	1.4	2.5	1.4	2.4	1.3
13	2.3	1.4	2.4	1.5	1.8	1.2	2.0	1.3
14	2.8	1.5	3.0	1.6	2.5	1.3	2.5	1.3
15	2.2	1.3	2.5	1.4	1.7	1.0	2.0	1.2
16	2.0	1.2	2.3	1.4	1.4	0.8	2.1	1.3
17	3.4	1.5	3.3	1.4	2.6	1.4	2.8	1.4
18	2.7	1.5	3.0	1.5	2.2	1.4	2.4	1.3
19	1.9	1.3	2.5	1.5	1.8	1.1	1.8	1.2
20	2.4	1.5	3.0	1.6	2.0	1.5	2.4	1.4

Magnitude Estimation Scale

	Amount				Performance Quality Variability			
	Supervisor		Subordinate		Supervisor		Subordinate	
Task	M	σ	M	σ	M	σ	M	σ
1	63.1	30.6	68.9	29.0	56.8	31.1	64.6	30.4
2	34.5	27.7	43.9	30.1	32.2	28.1	39.7	29.4
3	25.2	21.8	30.1	23.5	22.8	20.8	37.7	30.4
4	46.2	30.1	48.8	31.4	43.0	30.5	42.0	29.9
5	42.5	29.8	42.9	29.2	39.8	29.2	38.3	28.1
6	39.8	28.7	44.2	27.3	32.8	28.0	31.9	25.0
7	52.9	31.4	50.8	28.8	46.8	30.7	48.5	28.6
8	49.3	31.6	47.2	29.8	43.7	29.7	40.1	28.5
9	48.3	30.3	50.5	29.4	42.7	29.2	44.1	26.9
10	51.4	31.0	51.7	29.7	39.7	28.8	39.3	25.9
11	51.3	31.0	53.7	29.3	39.7	29.3	42.6	26.2
12	52.0	51.7	50.0	28.6	39.4	29.9	39.7	28.0
13	35.3	30.0	38.6	30.1	31.2	27.7	38.5	47.8
14	48.5	31.0	50.7	29.9	44.1	29.8	39.0	25.7
15	30.6	25.1	39.5	28.3	28.6	25.1	33.2	26.7
16	23.7	21.4	34.0	25.1	25.8	24.0	36.1	28.8
17	54.7	31.9	55.3	29.2	45.3	30.1	46.0	28.5
18	44.9	30.7	49.7	29.1	36.8	29.7	36.3	27.7
19	34.6	29.2	44.2	28.5	30.6	26.4	32.4	25.6
20	44.6	32.8	47.8	29.3	33.3	29.5	40.6	30.5

Table 3-6

Task Means and Standard Deviations for Munitions Maintenance Career Field

Categorical Scale

	Amount				Performance Quality Variability			
	Supervisor		Subordinate		Supervisor		Subordinate	
Task	M	σ	M	σ	M	σ	M	σ
1	2.4	1.5	2.5	1.5	2.0	1.3	2.0	1.3
2	2.0	1.3	2.4	1.5	1.6	1.0	2.1	1.5
3	2.3	1.5	2.3	1.5	1.8	1.1	2.1	1.4
4	1.7	1.1	1.8	1.2	1.5	0.9	1.6	1.2
5	1.8	1.2	2.0	1.4	1.7	1.1	1.5	0.9
6	1.7	1.2	1.8	1.3	1.4	0.8	1.3	0.8
7	2.2	1.4	2.3	1.4	1.7	1.0	1.8	1.2
8	1.8	1.0	2.0	1.3	1.4	0.8	1.5	1.1
9	2.2	1.4	2.3	1.4	1.7	1.0	2.0	1.3
10	2.8	1.5	3.0	1.6	2.4	1.3	2.5	1.5
11	3.1	1.6	3.2	1.6	2.6	1.4	2.7	1.5
12	1.7	1.0	1.8	1.1	1.4	0.8	1.5	1.0
13	2.4	1.4	2.6	1.4	2.1	1.3	2.1	1.4
14	2.2	1.4	2.4	1.5	1.9	1.2	1.9	1.3
15	2.1	1.3	2.0	1.3	1.7	1.0	1.7	1.2
16	2.6	1.7	2.7	1.7	2.1	1.4	2.2	1.5
17	1.9	1.3	2.3	1.5	1.7	1.1	1.9	1.4
18	1.9	1.3	1.9	1.4	1.6	1.0	1.6	1.1
19	2.2	1.3	2.2	1.3	1.7	1.1	1.8	1.2
20	2.1	1.3	2.5	1.5	1.6	1.1	2.1	1.5

Magnitude Estimation Scale

	Amount				Performance Quality Variability			
	Supervisor		Subordinate		Supervisor		Subordinate	
Task	M	σ	M	σ	M	σ	M	σ
1	34.8	29.7	39.3	29.7	26.0	22.6	26.6	23.5
2	27.4	26.5	40.2	71.4	22.5	19.7	25.2	23.0
3	31.4	26.9	35.5	29.5	23.1	20.9	26.6	23.5
4	20.3	18.7	24.5	22.3	19.5	17.9	18.9	18.6
5	23.8	23.3	30.6	27.6	21.4	19.2	23.3	22.3
6	22.0	22.0	28.6	26.0	18.1	15.9	22.5	20.9
7	30.1	25.3	33.7	25.8	23.1	18.2	27.0	23.2
8	19.8	17.7	26.0	22.7	17.4	15.9	20.0	19.1
9	31.6	26.3	36.6	28.4	24.0	19.7	24.9	23.1
10	46.8	30.8	52.1	31.5	39.5	27.3	39.5	29.1
11	52.5	31.9	54.4	31.5	43.0	28.0	42.8	29.5
12	18.8	15.5	26.3	22.2	18.0	16.1	19.4	18.5
13	35.6	27.2	41.7	27.6	29.8	23.3	32.4	26.1
14	30.2	25.8	40.8	30.7	27.3	24.0	25.9	23.6
15	30.8	27.2	33.4	26.5	22.1	19.1	23.1	20.7
16	40.3	33.4	43.2	32.6	29.3	26.7	32.7	29.0
17	26.1	25.4	36.1	29.3	23.8	22.3	28.1	25.6
18	25.1	26.5	31.7	29.0	20.5	18.8	20.6	19.6
19	28.6	24.4	37.5	27.9	21.6	18.3	26.7	24.0
20	25.7	23.4	41.4	30.4	18.7	17.8	35.4	29.6

scale performance quality variability data for the supervisors achieved a range from 1.4 to 2.6 (with a standard deviation range from 0.8 to 1.4). The range for the subordinates was 1.3 to 2.7 (with a standard deviation range of 0.8 to 1.5). The magnitude estimation scale produced supervisor mean range of 17 to 43 (with a standard deviation range of 16 to 28) and a subordinate mean range of 19 to 43 (with a standard deviation range of 19 to 30).

Discussion and Summary of Discrimination Analyses

The prior sets of analyses suggest that the techniques do little to discriminate among taxonomic classes when abilities are judged across tasks. On the other hand, the techniques seem more sensitive when tasks were judged across individual taxonomic classes. Table 3-7 summarizes the range of mean values yeilded by the separate methods and rater levels by career fields. In all corresponding cells, the range for task ratings across taxonomic classes is greater than the range for taxonomic classes across tasks. The ranges for the task ratings across classes seem to suggest acceptable sensitivity but the same can not be said for the taxonomic class across task data. This suggests that data of the nature here involved are best sought at the task level.

Regardless of scaling approach or set of judges, the data suggest that the two career fields involved in the pretest are not heavily loaded in perceptual/psychomotor requirements of the type included in our taxonomy. All distributions were skewed to the left. While the possibility of rater error exists, such an explanation does not seem tenable in view of the controls instituted, the diversity of the two career fields involved, and the experience range of the two subject groups.

Amount and Performance Quality Variability Comparisons

A visual inspection of the mean data presented in Tables 3-3 and 3-4 suggests a degree of association between the two judged variables--amount and performance quality variability. In order to examine further the association between these variables, product moment correlation coefficients were calculated. The resultant correlation coefficients are presented in Table 3-8.

The correlation between the judgments of amount and performance quality variability was moderate to high in six of the eight comparisons. A comparison of the supervisor and the subordinate correlation coefficients in Table 3-8 indicates, in all cases, slightly depressed coefficients for the subordinates. This suggests that the supervisors tended to judge a task as having greater performance quality variability for

Table 3-7

Range of Values Yielded by Separate Methods and Rater Levels in Two Career Fields

		Taxonomic Classes				Tasks			
Scaling Method		Categorical		Magnitude		Categorical		Magnitude	
Career Field		A*	PQV**	A	PQV	A	PQV	A	PQV
Fire Protection	Supervisor	1.5	0.8	25	19	2.2	1.7	39	34
	Subordinate	0.9	0.4	17	9	1.6	1.9	39	33
Munitions Maintenance	Supervisor	1.5	0.5	25	8	1.4	1.2	34	26
	Subordinate	1.6	0.4	24	13	1.4	1.4	30	24

* A = Amount

** PQV = Performance Quality Variability

Table 3-8

Product Moment Correlation Between Amount and Performance Quality Variability (N = 13 Abilities)

Fire Protection (571XX)

Variable	r
Supervisor, categorical scale	.87
Subordinate, categorical scale	.23
Supervisor, magnitude scale	.93
Subordinate, magnitude scale	-.15
Mean_r =	.65

Munitions Maintenance (461XX)

Variable	r
Supervisor, categorical scale	.90
Subordinate, categorical scale	.76
Supervisor, magnitude scale	.84
Subordinate, magnitude scale	.65
Mean_r =	.81
Grand Mean_r =	.74

a particular ability when the task required a greater amount of the ability for successful performance. Conversely, those tasks that varied less in the performance quality variability, as a function of a specific ability, were regarded by the supervisors as requiring less of the ability for successful performance. Subordinates, on the other hand, seemed to make slightly more independent judgments on the amount and performance quality variability factors.

Moderately high correlations were obtained when the average correlation (obtained by averaging the z-coefficient equivalents) was obtained for each specialty--.65 and .81 for Fire Protection and Munitions Maintenance career fields, respectively. The estimate of the population value was .74 when the eight separate correlation coefficients were averaged.

The correlational data, taken as a group, suggest that the two questions are moderately interdependent. There is an indication that some association exists between the perceptions of the amount of an ability required to perform a task and the performance quality variability it produces. However, from the point-of-view of job analytic thoroughness, it seems that both questions may best be considered in any job analysis which aims to be complete.

Supervisor and Subordinate Comparisons

If the judgments of supervisors and subordinates can be demonstrated to be associated, then a position could be taken that supervisor-subordinate judgments may be combined prior to the analytic treatment of the data, and in future work, distinctions between the two groups may be disregarded. In this regard, note the similarity between the mean data of the supervisors and the subordinates for tasks and for performance quality variability reported in Tables 3-3, 3-4, 3-5, and 3-6.

Table 3-9 presents the correlation between supervisor and subordinate judgments for amount and performance quality variability separately, by rating scale type. The correlation coefficients of Table 3-9 show a close association between the supervisor and subordinate ratings of amount, regardless of type of rating scale.

The average correlation between supervisory and subordinate judgments in the Fire Protection specialty, across rating scales, amount, and performance quality variability was .54. An average of .84 was obtained for the Munitions Maintenance specialty. An estimate of the population value was obtained by averaging the correlations across both specialties. The obtained correlation, .72, was considered moderately high.

Table 3-9

Product Moment Correlations Between Supervisors and Subordinates (N = 13 Abilities)

Fire Protection (571XX)

Variable	r
Amount, categorical scale	.79
Performance quality variability, categorical scale	-.10
Amount, magnitude scale	.91
Performance quality variability, magnitude scale	-.09
Mean_r =	.54

Munitions Maintenance (461XX)

Variable	r
Amount, categorical scale	.94
Performance quality variability, categorical scale	.63
Amount, magnitude scale	.91
Performance quality variability, magnitude scale	.67
Mean_r =	.84
Grand Mean_r =	.72

Accordingly, some basis exists for combining the data produced by the two sets of respondents or for using only one or the other group of respondents in job analytic studies of the type considered here.

Test-Retest Reliability

In order to collect data relative to the response stability within judges, the 24 raters who participated in the personal interview reevaluated a sample of 10 tasks on each of the 13 perceptual/psychomotor taxonomic classes. The group was divided such that half of each of the four groups of raters (supervisors-Munitions Maintenance, subordinates-Munitions Maintenance, supervisors-Fire Protection, subordinates-Fire Protection) reevaluated 10 tasks using either the categorical or the magnitude estimation scale.

The Lawlis and Lu (1972) approach was used to determine the agreement of ratings on two separate occasions. An advantage of this technique over other conventional reliability measurements (e.g., correlation) is in its power to measure relationships when the total variance of range is small, as is often the case with rating scales and in the case of the present data set. Within the Lawlis and Lu approach the null hypothesis of agreement by chance is tested through the chi-square formula (with one degree of freedom):

$$\chi^2 = \frac{(N_1 - Np - .5)^2}{Np} + \frac{(N_2 - N(1 - p) - .5)^2}{N(1 - p)}$$

where: N = number of abilities being rated
N_1 = number of observed agreements
N_2 = number of observed disagreements
p = the probability of k judges achieving agreement by chance
$.5$ = correction for continuity

A statistically significant χ^2 value indicates that the observed agreement is not due to chance. The p value in the formula is obtained from a table of probabilities of chance agreement, based on a rectangular distribution model (i.e., every judgment has the same probability of occurring under the hypothesis that the judges have no understanding of the scale and their ratings are random). The determinations of agreement were based on the most rigorous criterion--identical ratings on the two occasions. This is an especially stringent criterion. The resultant χ^2 values are presented in Table 3-10.

The coefficients of agreement resulting from this analysis were high and indicate non-chance agreement over the two occasions.

Table 3-10

Coefficients of Agreement Between Two Evaluations of the Same Tasks

Rater	Chi-Square
Fire Protection (571XX)	
Supervisor, amount-categorical	17.97*
Supervisor, amount-magnitude	24.31*
Subordinate, amount-categorical	24.31*
Subordinate, amount-magnitude	17.97*
Supervisor, performance quality variability-categorical	24.31*
Supervisor, performance quality variability-magnitude	12.50*
Subordinate, performance quality variability-categorical	24.31*
Subordinate, performance quality variability-magnitude	49.12*
Munitions Maintenance (461XX)	
Supervisor, amount-categorical	12.58*
Supervisor, amount-magnitude	8.16*
Subordinate, amount-categorical	2.20
Subordinate, amount-magnitude	49.12*
Supervisor, performance quality variability-categorical	49.12*
Supervisor, performance quality variability-magnitude	2.20
Subordinate, performance quality variability-categorical	17.97*
Subordinate, performance quality variability-magnitude	24.31*

* Statistically significant at or below the .01 level of confidence.

Interrater Agreement

Agreement between raters was calculated for each perceptual/psychomotor taxonomic class by rater type (supervisor and subordinate), type of scale (categorical and magnitude estimation), and evaluative factor (amount and performance quality variability).

To accomplish these interrater reliability estimates, tables were constructed which contained the number of responses for each scale value selected by task. In this process, the magnitude estimation scale responses were collapsed into five category units, such that responses between 0 and 19 were counted as response category 1; responses between 20 and 39 were counted as response category 2, etc.

To determine the percentage of agreement on each ability, the following steps were taken:

1. For a given data set and each task within the set, select the response category containing the largest number of responses as the modulus.
2. For each task, sum the number of responses in the modulus category with those in the two response categories on the sides of the modulus (if the modulus is the first or last response category, add all responses in the two units closest to the modulus). This is the agreement sum.
3. Sum the agreement sums over all 20 tasks.
4. Obtain the total number of responses made for all 20 tasks (e.g., if there were 24 raters and each evaluated 20 tasks, then the total number of possible responses is 480).
5. Divide the result from step 4 into the result from step 3 to obtain the percentage of agreement among raters.

Tables 3-11 and 3-12 present the resultant interrater agreement percentages for the categorical scale and the magnitude estimation scale, respectively. The average percentage of agreement was obtained for each perceptual/psychomotor ability, across all ratings in both specialties and separately by specialty, rater type, and evaluation factor. The two tables indicate that the minimum percentage of agreement was 76 on both the categorical and magnitude estimation scales for the Position Memory ability and for Visual Memory on the categorical scale.

Table 3-11

Percentage Agreement Among Raters for the Perceptual/Psychomotor Abilties on the Categorical Scale Judgments

Perceptual/ Psychomotor Ability	Fire Protection				Munitions Maintenance				
	Supervisor		Subordinate		Supervisor		Subordinate		
	A	PQV	A	PQV	A	PQV	A	PQV*	Mean
FD	75	82	74	80	87	85	79	85	81
MD	79	78	79	76	84	89	82	83	81
CP	82	80	73	81	87	89	89	88	84
RC	80	79	79	80	92	90	90	86	85
VM	73	79	71	74	73	82	73	81	76
VSA	69	77	74	83	77	83	74	81	77
PM	74	76	72	78	71	87	72	78	76
AD	83	80	75	78	81	87	82	84	81
AM	78	75	70	76	84	88	74	80	78
CLP	84	86	71	76	74	87	73	81	79
DP	79	81	73	75	93	91	87	84	83
DA	82	85	76	80	89	93	79	87	84
KM	79	83	71	73	97	90	97	79	84
Mean	78	80	74	78	84	88	81	83	

* A = Amount

PQV = Performance Quality Variability

Table 3-12

Percentage Agreement Among
Raters for the Perceptual/Psychomotor Abilities
on the Magnitude Estimation Scale Judgments

Perceptual/ Psychomotor Ability	Fire Protection				Munitions Maintenance				
	Supervisor		Subordinate		Supervisor		Subordinate		
	A	PQV	A	PQV	A	PQV	A	PQV*	Mean
FD	69	77	77	81	92	93	89	91	84
MD	74	76	77	79	86	93	83	85	82
CP	77	78	76	79	94	94	92	91	85
RC	77	81	83	82	97	93	93	93	87
VM	69	70	72	78	80	90	74	88	78
VSA	71	78	72	79	83	91	81	86	80
PM	68	70	67	77	79	89	70	85	76
AD	83	86	79	83	92	95	88	94	88
AM	85	87	84	80	93	93	89	91	88
CLP	95	94	88	86	85	93	80	91	89
DP	79	86	80	82	94	94	85	92	87
DA	83	91	83	87	89	91	85	95	88
KM	86	91	80	81	99	96	96	97	91
Mean	78	82	78	81	89	93	85	91	

* A = Amount

PQV = Performance Quality Variability

The average percentage of agreement ranged from 76 to 85 for the categorical scale judgments and from 76 to 91 for the magnitude estimation scale judgments.

The agreement among the raters, in all cases, seems acceptably high. It seems that the raters uniformly understood and interpreted the rating methods and the definitions of the taxonomic categories. Such a finding supports the usefulness of the methods and procedures employed.

Intercorrelation Among Abilities

The taxonomic classes were selected with consideration of unidimensionality (uniqueness) as a partial criterion. However, some insight into the empirical relationship among the various abilities was required.

The perceptual/psychomotor ratings were intercorrelated to establish the relationship among the abilities. The resultant intercorrelation matrices are presented as Appendix C to this report.

Frequency distributions (in which supervisor and subordinate data were combined) of the results are presented as Tables 3-13 and 3-14. The frequency distributions were constructed to reflect the logic that the class interval $\leq .30$ = little or no relationship, the class interval .31 to .60 = moderate relationship, and $\geq .61$ = high relationship. Most of the intercorrelations in both tables are in the below .30 or the .31 to .60 ranges. This indicates some degree of independence or uniqueness among the perceptual/psychomotor abilities.

The perceptual/psychomotor taxonomic classes that were highly intercorrelated with others were examined to determine the elements that were common to the intercorrelated abilities.

Four different correlations of .80 or above occurred with some frequency in both the amount and performance quality variability judgments. These involved the following taxonomic classes: (a) Manual Dexterity and Control Precision, (b) Visual Memory and Position Memory, (c) Visual Speed and Accuracy and Position Memory, and (d) Auditory Discrimination and Auditory Memory. The common elements in the Manual Dexterity and Control Precision abilities are the arm and hand manipulations and movements. The major difference between them is that in one case objects (such as tools and materials) are manipulated, whereas control mechanisms (such as levers and pedals) are manipulated in the other. The obvious common element in the Visual Memory and

Table 3-13

Frequency Distribution of Intercorrelations Among Taxonomic Classes for Amount

Amount-Categorical Scale

Fire Protection

Correlation	N	Percent
≤ .30	26	17
.31 - .60	94	60
≥ .61	36	23
	156	

Munitions Maintenance

Correlation	N	Percent
≤ .30	95	61
.31 - .60	47	30
≥ .61	14	9
	156	

Amount-Magnitude Estimation Scale

Fire Protection

Correlation	N	Percent
≤ .30	16	10
.31 - .60	65	42
≥ .61	75	48
	156	

Munitions Maintenance

Correlation	N	Percent
≤ .30	100	64
.31 - .60	42	27
≥ .61	14	9
	156	

Table 3-14

Frequency Distribution of Intercorrelations Among Taxonomic Classes for Performance Quality Variability

Performance Quality Variability-Categorical Scale

Fire Protection

Correlation	N	Percent
≤ .30	20	13
.31 - .60	79	51
≥ .61	57	37
	156	

Munitions Maintenance

Correlation	N	Percent
≤ .30	8	5
.31 - .60	42	27
≥ .61	106	68
	156	

Performance Quality Variability-Magnitude Estimation Scale

Fire Protection

Correlation	N	Percent
≤ .30	8	5
.31 - .60	43	28
≥ .61	105	67
	156	

Munitions Maintenance

Correlation	N	Percent
≤ .30	28	18
.31 - .60	80	51
≥ .61	48	31
	156	

the Position Memory classes is the reliance on memory, to recall things that were seen in the past for the first class and to recall the position of things from past experience in the latter class. The reason for the association between the Visual Speed and Accuracy class and the Position Memory class is not entirely clear. Finally, Auditory Discrimination and Auditory Memory share the common element of sound discrimination.

Categorical and Magnitude Estimation Scale Comparisons

The data presented in prior sections suggested somewhat close agreement in the results produced by the two different scaling approaches employed in the pretest. Several analyses were performed to determine the statistical relationship between the two different rating scale approaches.

Table 3-15 presents the product moment correlation between the categorical and the magnitude estimation scaling for various situations. The correlation coefficients were considerably higher for the Munitions Maintenance raters as opposed to the Fire Protection raters. Within both specialties, the supervisors tended to be more consistent across the rating scales than their subordinates. However, averaging the correlations across both specialties to obtain an estimate of the population value resulted in a relatively high degree of relationship between the two scaling approaches, $r = .80$.

The relationship between the two scaling procedures was further examined visually. Graphs of the mean results from the two scaling approaches are presented in Figures 3-1 through 3-4. To plot the two sets of results on the same axes, a set of equivalencies of scale interval midpoints was established. The magnitude estimation scale was divided into five segments: 0 to 19, 20 to 39, 40 to 59, 60 to 79, and 80 to 100, and the midpoint of each magnitude estimation scale segment was equated to each scale point on the categorical scale in the following manner:

Magnitude Midpoint	Categorical Scale Value
10	1
30	2
50	3
70	4
90	5

The supervisor and subordinate judgments were combined.

101

Table 3-15

Product Moment Correlation Between Categorical and Magnitude Estimation Scaling Approaches (N = 13 Abilities)

Fire Protection

Variable	r
Supervisors, amount	.53
Supervisors, performance quality variability	.61
Subordinates, amount	.90
Subordinates, performance quality variability	.52
Mean$_r$ =	.69

Munitions Maintenance

Supervisors, amount	.96
Supervisors, performance quality variability	.86
Subordinates, amount	.91
Subordinates, performance quality variability	.64
Mean$_r$ =	.88
Grand Mean$_r$ =	.80

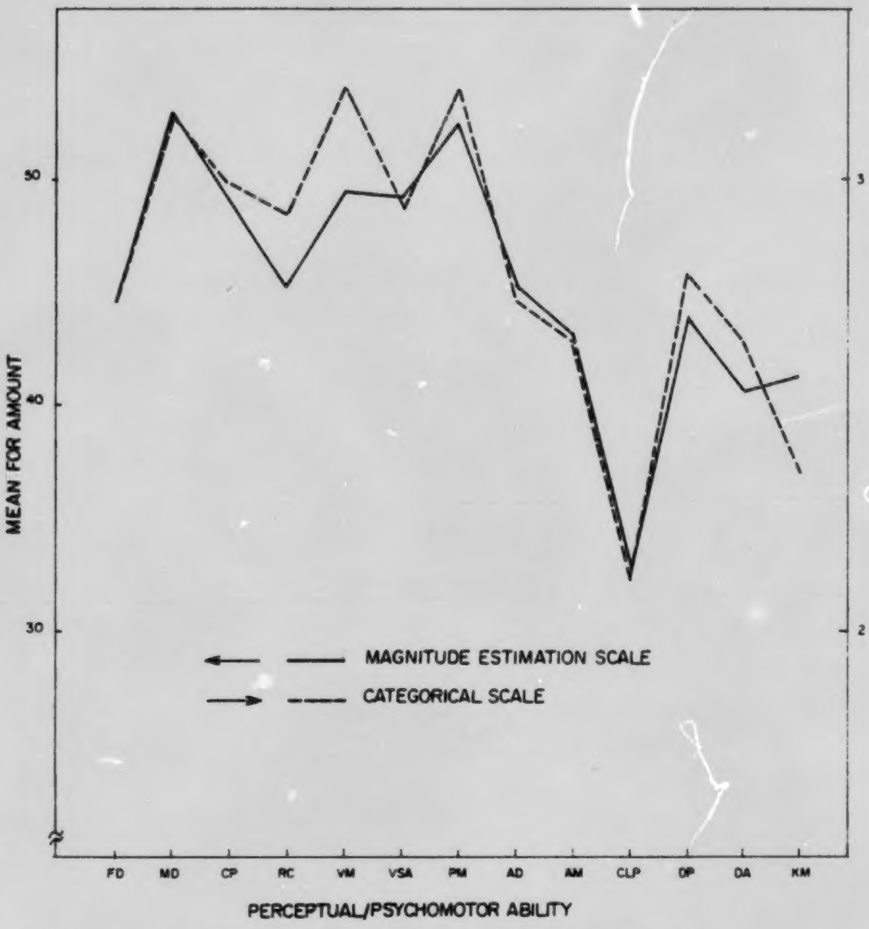


Figure 3-1. Correspondence between two scaling approaches for the Fire Protection specialty on amount.

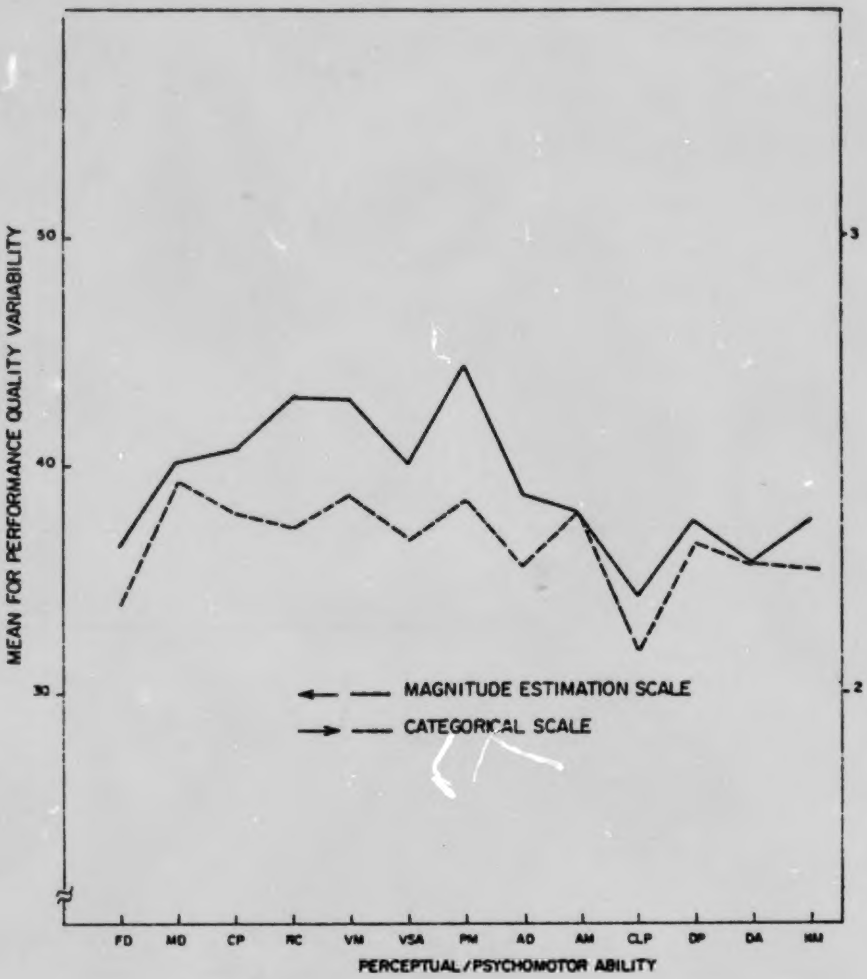


Figure 3-2. Correspondence between two scaling approaches for the Fire Protection specialty on performance quality variability.

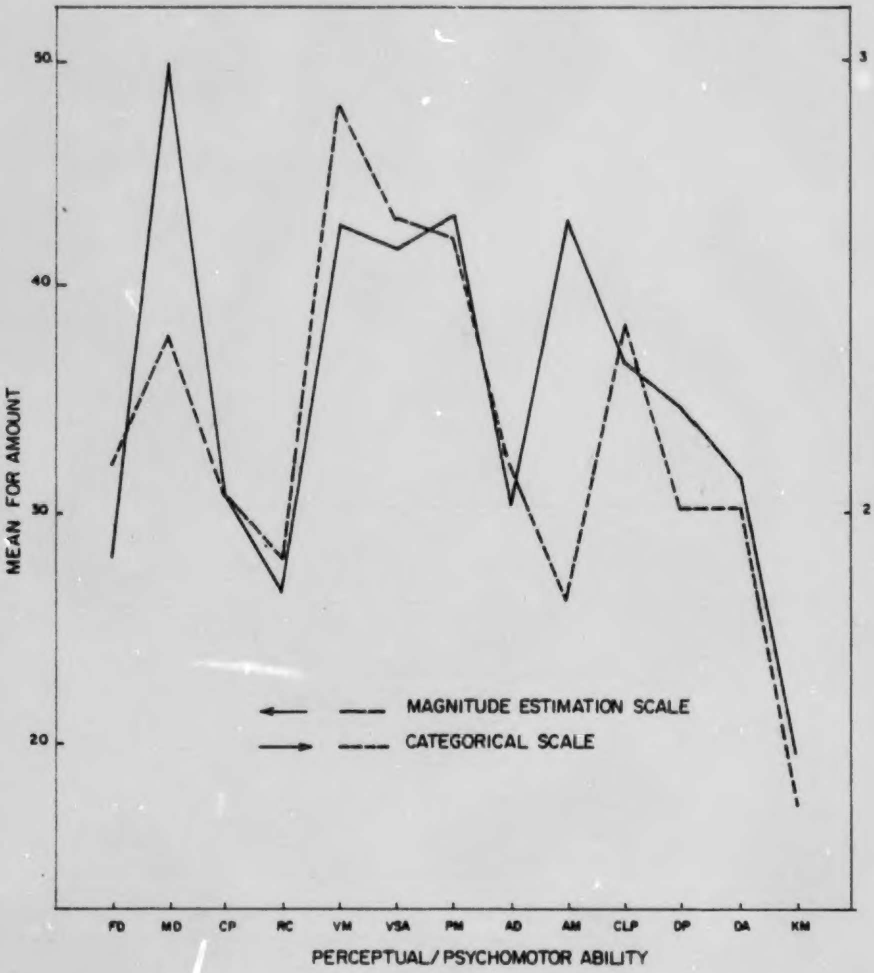


Figure 3-3. Correspondence between two scaling approaches for Munitions Maintenance specialty on amount.

105

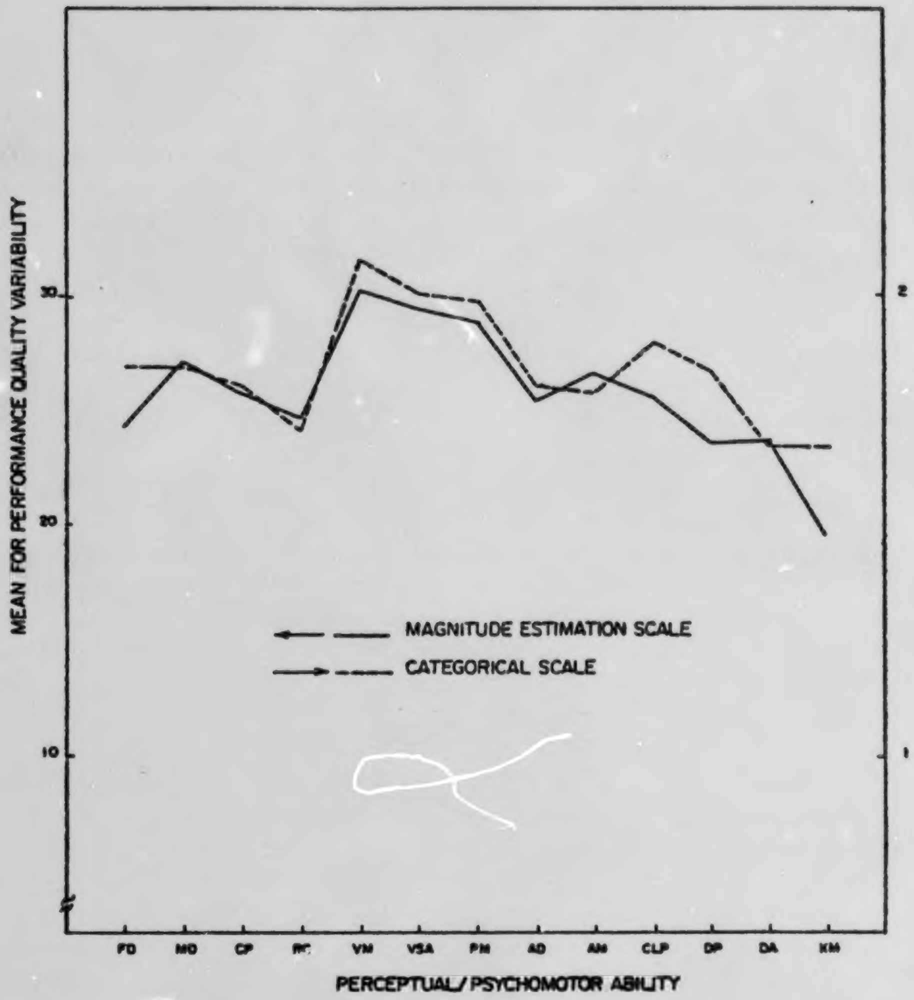


Figure 3-4. Correspondence between two scaling approaches for Munitions Maintenance specialty on performance quality variability.

The graphs all show close similarities in shape and elevation with the exception of Auditory Memory in Figure 3-3.

Both the correlational data and the graphic presentations suggest that the task-taxonomic category judgments are not method sensitive. This holds for both the amount and the performance quality variability factors.

Properties of Scales

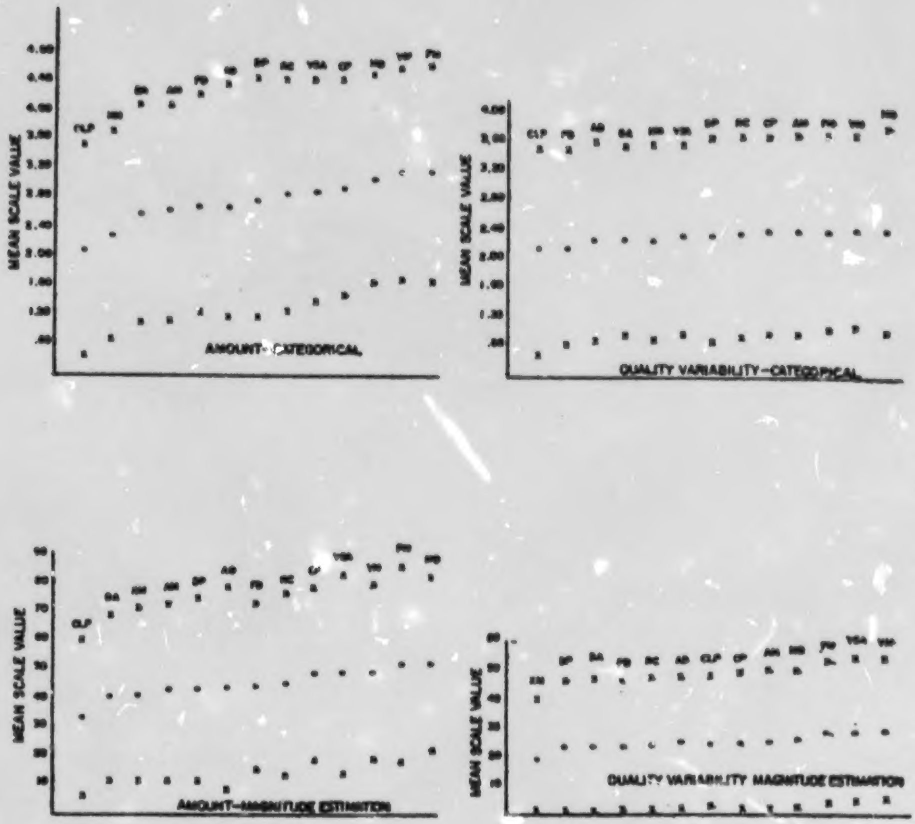
Another set of insights into the nature of the scales provided by the two scaling approaches is provided by plotting the means in ascending order and showing the standard deviation of each mean on the same plot. If the standard deviations increase at the scale extremes, there is a suggestion that the raters are more sensitive to the scale extremes than to the central area. Such a scale property is not usual in psychological continua but is usual for physical continua. Quite obviously scales of the latter type (prothetic scales) do not possess a constant Weber function and are less preferred than scales of the former type (metathetic scales).

The data in Tables 3-3 and 3-4 are presented graphically in Figures 3-5 and 3-6. As a result of the agreement between the supervisor and subordinate judgments, as indicated by the prior analyses, the judgments of the two groups of judges were combined. The graphs present the 13 ability means, and their standard deviations, in an ascending scale value order. Separate graphs are presented for the amount and performance quality variability, on each of the two types of rating scales, for each of the two specialties pretested.

In addition, the graphs of the mean data place the 13 abilities in a perspective relationship to each other. For example, Figure 3-5 indicates several abilities that are high on the amount of the abilities required to perform the listed tasks (e.g., Manual Dexterity, Visual Memory, Position Memory) and several that are low on the amount of the abilities required (e.g., Clerical Perception and Kinesthetic Memory). The plots indicate almost constant standard deviations regardless of type of scale (categorical or magnitude) or factor judged (amount or performance quality variation). This suggests the utility of either type of scale for job analytic studies of the present type.

Combined Profiles

Figures 3-5 and 3-6 presented separate profiles of the amount and the performance quality variability involvement of the abilities

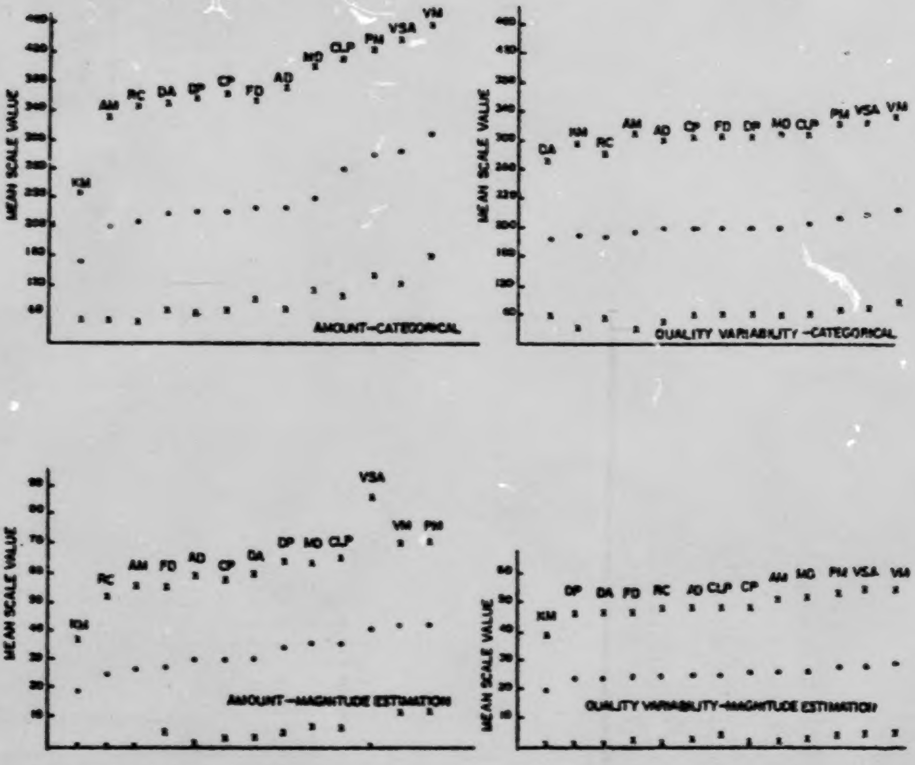


FD = Finger Dexterity
AD = Auditory Discrimination
CP = Control Precision
RC = Rate Control
VM = Visual Memory
VSA = Visual Speed and Accuracy

PM = Position Memory
MD = Manual Dexterity
AM = Auditory Memory
DP = Depth Perception
DA = Divided Attention
KM = Kinesthetic Memory

CLP = Clerical Perception

Figure 3-5. Means and standard deviations of taxonomic classes for Fire Protection career field.



FD = Finger Dexterity
AD = Auditory Discrimination
CP = Control Precision
RC = Rate Control
VM = Visual Memory
VSA = Visual Speed and Accuracy
PM = Position Memory
MD = Manual Dexterity
AM = Auditory Memory
DP = Depth Perception
DA = Divided Attention
KM = Kinesthetic Memory
CLP = Clerical Perception

Figure 3-6. Means and standard deviations of taxonomic classes for Munitions Maintenance career.

represented by each taxonomic class in the two technical specialties. Another approach to portraying the taxonomic class involvement is to combine the amount and the performance quality variability data into one overall index. The combinatorial approach selected was the geometric mean:

$$\text{Total Involvement} = \sqrt{(A^2 + PQV^2)}$$

where: A = amount
PQV = performance quality variability

This is the familiar "city block" model which considers the two vectors to be orthogonal. Of course, other combinatorial techniques are possible and possibly more defensible.

The combined profiles are presented as Figures 3-7 and 3-8. These represent the overall involvement of the taxonomic classes in each of the two Air Force career fields included in the pretest.

Interview Findings

A semistructured interview was conducted with 24 of the supervisors and subordinates who participated in the major pretest data collection effort. The interview attempted to inquire into problems associated with the data collection techniques, the alternate scaling approaches, the taxonomy, and the like from the point of view of the respondent.

Two abilities were suggested in response to the question "What other perceptual/psychomotor abilities are required in the performance of tasks that were not contained in the data collection forms?" Most respondents thought that the taxonomy was complete and thorough. Several interviewees, in both career fields, suggested that strength and physical stamina[2] were important, e.g., for the continued handling of heavy munitions in the Munitions Maintenance career field and in the rescue of personnel (described as an activity that "exhausts and drains people quickly") in the Fire Protection career field. One person suggested that color perception might be an important consideration in the Fire Protection specialty, especially for reading hazard codes. On balance, the interviewees were largely of the opinion that the 13 abilities included in the taxonomy were a complete and satisfactory listing of perceptual/psychomotor abilities involved in job performance in their career fields.

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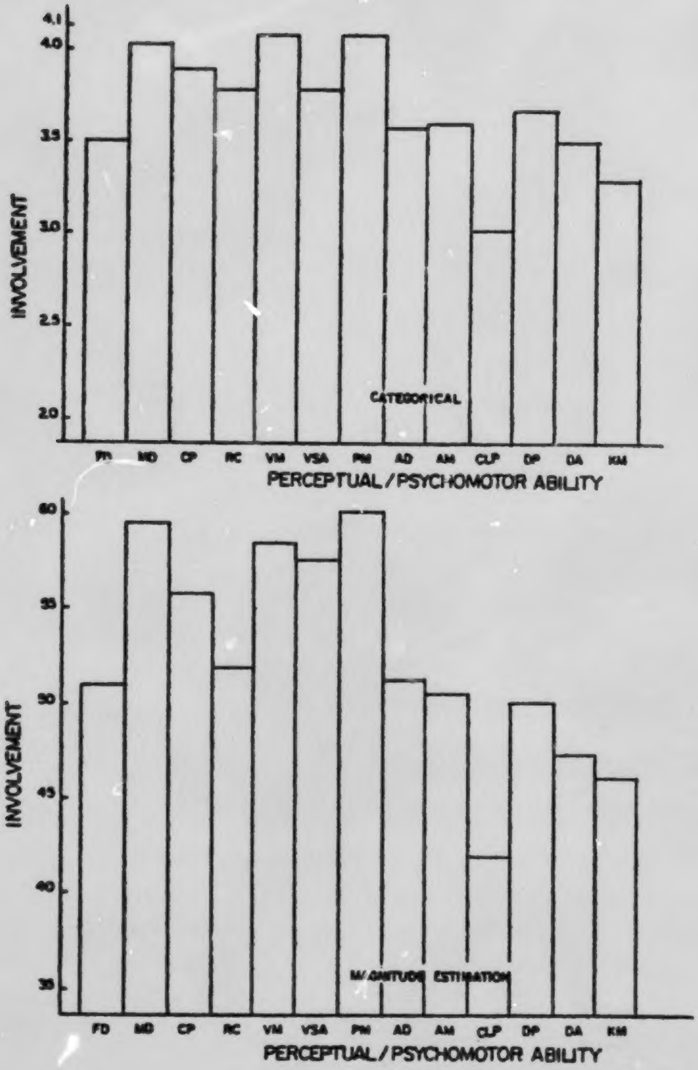
[2] A strength requirements survey was taking place at about the same time as the present work.



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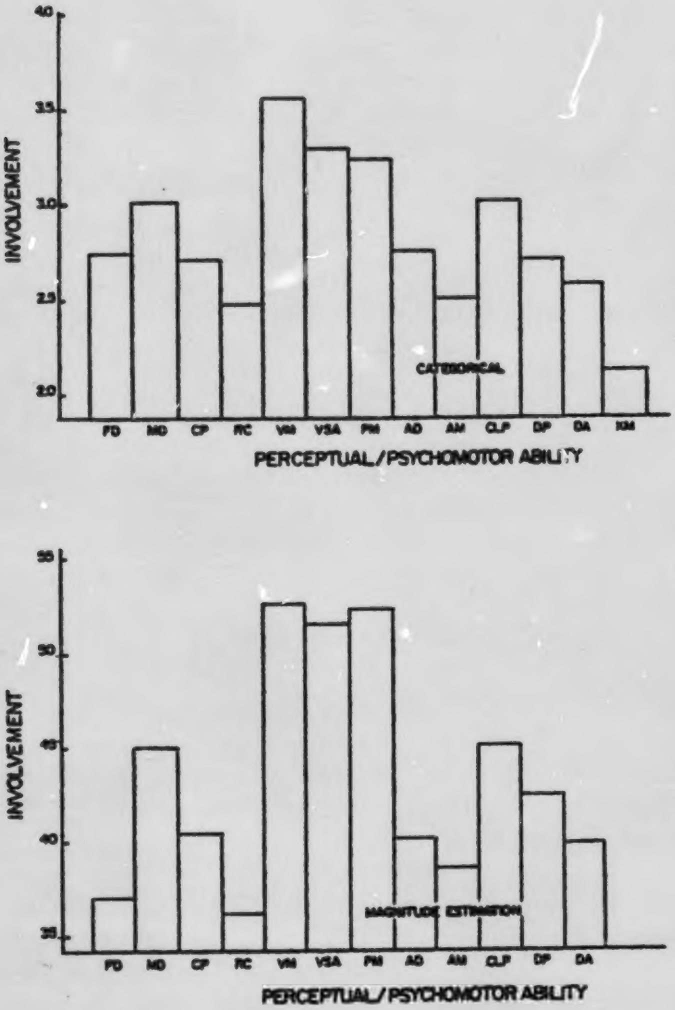
PM = Position Memory
AD = Auditory Discrimination
AM = Auditory Memory
CLP = Clerical Perception
DP = Depth Perception
DA = Divided Attention
KM = Kinesthetic Memory

Figure 3-7. Involvement of perceptual/psychomotor abilities in Fire Protection career field.



FD = Finger Dexterity
MD = Manual Dexterity
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RC = Rate Control
VM = Visual Memory
VSA = Visual Speed and Accuracy
PM = Position Memory
AD = Auditory Discrimination
AM = Auditory Memory
CLP = Clerical Perception
DP = Depth Perception
DA = Divided Attention
KM = Kinesthetic Memory

Figure 3-8. Involvement of perceptual/psychomotor abilities in Munitions Maintenance career field.

Several interviewees alluded to the possibility that different amounts of an ability could be required at different locations. For example, Fire Protection personnel may have more occasion to use the "Divided Attention" ability at large air bases because of (a) the more complex communications systems at such a location and (b) the greater number of radios being attended at the same time. A Munitions Maintenance interviewee suggested that the amount of "Manual Dexterity" could vary from base to base, depending on the amount of heavy versus light munitions that were handled. This suggests the need for including a variety of bases in surveys such as the present one. The interviewees who made these suggestions all have been assigned to other bases prior to their current assignment. Consequently, their suggestions were, more than likely, based on personal experience rather than conjecture or supposition.

An evaluation of the perceptual/psychomotor definitions (question 6) indicated that all the interviewees understood the definitions adequately and were able to relate them to the tasks performed in their career field. One interviewee suggested that the examples offered in the definitions list might be more meaningful if they pertained to motor vehicles, such as cars and trucks, rather than aircraft.

The interviewees were presented with a list of 10 adjectival statements (question 7); five were positive statements and five were negative. The statements appeared in a random order in the list. The interviewees were asked to select any two statements which best described their opinion of the category scale and another two statements which best described their opinion of the magnitude estimation scale. The distribution of responses, by career field and by supervisor-subordinate, indicated such minor differences that the responses were grouped (across both specialties and level) for summary purposes. The data indicated a positive disposition toward the category scale. A total of 96 responses was recorded (four responses from each interviewee, two for each type of scale). Of the total number of responses, 54 (56%) were positive, while 42 (44%) were negative. Of the positive responses, 38 (70%) favored the category scale over the magnitude estimation scale. Similarly, of the negative responses, 32 (70%) were more negative toward the magnitude estimation scale. An alternative view of these data is that when considering only the category scale evaluations, 38 (79%) of the responses were favorable; when the evaluations of the magnitude estimation scale were analyzed, 16 (33%) were positive. On the basis of response frequency, the three statements that best characterize the opinions of the category scale, respectively, were "easy to use," "easy to interpret," and "a good approach." Conversely, the three most frequently selected options describing opinions of the magnitude estimation scale were "difficult to use," "provides inadequate information," and "poor approach."

The interviewees were asked to evaluate the difficulty they had in using the two scaling approaches (question 8). They selected one option from five, which best described their opinion on the difficulty issue. The responses on the difficulty issue appear to mirror those given in response to the preference question. Approximately twice as many interviewees (21 versus 12) rated the category scale as easier ("moderately" or "very"). In a similar vein, five times as many interviewees (9 versus 2) rated the magnitude estimation as difficult. The remaining responses fell in the "neither difficult nor easy" option. However, in general, both scales were considered somewhat easy to use. Three times as many of the interviewees (33 versus 11) selected the "very easy" or "moderately easy" options rather than the "difficult" options for both scales.

Several suggestions were made by the interviewees regarding the two types of scales. The comments shed additional light on the issue of the type of scale which is most acceptable from the point of view of the respondent:

- It is difficult to use percentages [magnitude estimation scale].
- There are too many choices to consider [magnitude estimation scale].
- I can't nail down an answer and be exact with the magnitude scale.
- Don't include the percentages in the category scale - it's confusing and too much like the magnitude scale.

An open-ended question was asked in order to obtain suggestions for improving the final data collection instruments. Some of the suggestions were:

- Use only Part I [amount]. I got confused between the two concepts and had to concentrate very hard on the quality of performance section.
- Section II [performance quality variability] was very difficult. I had to read it twice to understand it.
- It was difficult at first. But after the second column it was easy.
- Place the scales on the pages that have to be filled out.

- Make the examples in the definition list specific to my career field.
- Don't use perceptual/psychomotor. Use terms like skill or ability.

The procedures employed in the administration of the forms and the data collection instruments themselves including the definitions of taxonomic classes) were largely acceptable to the pretest sample of respondents and appeared to require only minor modifications to improve clarity and meaningfulness (e.g., wording).

Discussion of Pretest Results

Probably, the major purpose of the pretest was to determine whether or not the task list approach represents a workable technique for collecting taxonomic class involvement information for Air Force specialties. From the overall point of view, it seems that the technique was successful for acquiring the required data. The supervisors and the subordinates who were involved were able to understand the taxonomy, the scaling procedures, and the methods for completing the forms.

Other issues were also involved in the pretest investigations. The first of issues related to the sensitivity/discriminating power of the scales/taxonomy. There was some indication that the range of responses was restricted--especially relative to taxonomic classes. This restriction may be a true representation of the different ability requirements or it may represent a scaling problem. The safer course seemed to be to accept the latter explanation and to make some modifications in the scaling procedure for the subsequent large scale data collection effort. On the other hand, when tasks were judged across taxonomic classes, the range restriction was not so pronounced. This finding supports the use of the task approach that was adopted at the outset.

A second specific issue involved the independence of two considerations: the amount of a taxonomic class required for task performance and the performance quality variability produced by the class. The results indicated a moderate association between the results yielded by the two factors. There was some indication that the subordinates were better able than their supervisors to distinguish between the amount and the performance quality variability factors. However, the two factors seemed to be sufficiently independent to warrant continuation of the use of both factors during the extended data collection planned for the next research phase.

There was evidence supporting the test-retest reliability of the techniques and the interrater reliability seemed acceptably high. The pretest data, in this regard, support the use of the methods/techniques of the pretest during later study phases.

Some indication was shown of a statistical relationship among the 13 taxonomic classes but the associations were, for the most part, not strong. Moreover, the respondents said that they had little difficulty in understanding or employing the taxonomy. With this, as well as the obtained reliability, in mind, revision of the taxonomy did not seem warranted at this juncture.

The issue of the relationship between estimates made by supervisory as compared to subordinate personnel was investigated from a number of points-of-view. In general, there was a close relationship between the taxonomic information yielded by supervisors and by subordinates whether type of scaling procedure, career field, taxonomic class, or rating factor was involved. The overall indication seemed to be that the data yielded by the two personnel levels will be essentially equivalent and that either or both subject groups could form the basis for the data to be collected in subsequent study phases.

Similarly, there seemed to be little effect of type of scaling procedure on the emergent data regardless of rating factor. However, the categorical scaling procedure seemed preferred over the magnitude procedure by the repondents. Accordingly, it seemed that the categorical procedure should be employed in subsequent data collection efforts.

All of this suggested, that with some modification in wordings and scaling, judgments possessing adequate quality could be obtained in subsequent work phases.

IV. PERCEPTUAL/PSYCHOMOTOR REQUIREMENTS OF 35 AFSCS

With the results of the pretest of methods and procedures on hand, a major effort to acquire information about the perceptual/psychomotor requirements of Air Force specialties was instituted.

Changes in Forms and Procedures

On the basis of the pretest results, it was decided to employ the categorical rating procedure during the major effort. This scale seemed to yield data of equivalent quality, as compared with the magnitude estimation procedure, and to be easier and more acceptable to the respondents. However, in an effort to increase the range of responses, two additional categories were added to the scale--extending it from a five category to a seven category scale. Additionally, and for the same purpose, the percentage values contained in the definitions were deleted. Otherwise, the methods and procedures of the data acquisition remained the same as for the pretest.

Sample

Career Fields

A sample of 35 Air Force career fields was selected for inclusion in the present work. To obtain this sample, the Airman Classification Manual (AFM 39-1) was initially reviewed to develop an ad hoc list that would contain career fields in which different types of perceptual/psychomotor requirements seem needed (e.g., manual dexterity, visual memory, clerical perception). This list consisted of 75 career fields.

All specialties which did not possess an Occupational Survey Report task listing were eliminated from further consideration. The final sample was selected from the remaining set of 55 on the basis of aptitude requirements for entry into the career fields.

The four aptitude areas used by the Air Force to group career fields are mechanical, administrative, general, and electronics. The aptitude minimums for each career field were listed hierarchically within each of the four aptitude areas. The distribution was then divided into three approximately equal segments. The highest group of minimum aptitude scores was labelled H (high); the middle group was labelled M (moderate) and the lowest group was labelled L (low). The arrangement of cutoff points of aptitude scores, for each aptitude area was:

117

Mechanical

High: 60 or above
Medium: 50-59
Low: 40 or below

Administrative

High: 70 or above
Medium: 50-69
Low: 40 or below

General

High: 70 or above
Medium: 50-69
Low: 40 or below

Electronics

High: 60 or above
Medium: 50-59
Low: 40 or below

The final selection of career fields is presented in the matrix shown as Table 4-1. The career fields sampled reflect an equal representation of each of the aptitude areas and of the high, medium, and low cutoff points on the aptitude score requirements. Where more than one career field was available for selection, that career field was selected which had a larger number of personnel assigned. At the time of the sample selection, the range of personnel (including the skill levels 3 through 9) for the career fields listed was 527 to 28,337. The career fields in Table 4-1 were identified for the 3-and 5-skill levels.

Air Force Bases

Following the career field sample selection, the next sample to be selected was Air Force bases. The intent in sampling bases was to conduct surveys at a variety of bases so that geographic and situational differences, if any, could be represented in the ultimate data. A second consideration in the air base selection was the air base's major command, e.g., Strategic Air Command (SAC), Tactical Air Command (TAC), or Military Air Command (MAC). Table 4-2 shows the Air Force base sample.

Table 4-1

Sample of Air Force Career Fields by Aptitude Score Minimumus

	High	Medium	Low	N=
Mechanical	461X0 (Munitions Maintenance) 462X0 (Weapons Mechanic) *	605X0 (Air Passenger and Air Cargo Specialist) 114X0 (Aircraft Loadmaster) 443X0 (LGM 25 Missile Mechanic)	603X0 (Vehicle Operator/Dispatcher) 631X0 (Fuels Specialist) 552X0 (Carpentry and Masonry Specialist)[A]	8
Administrative	651X0 (Procurement Specialist) 701X0 (Chapel Management) 705X0 (Legal Services)	293X3 (Radio Operator) 732X0 (Personnel) 272X0 (Air Traffic Control Operator Technician)	702X0 (Airman Administration) 611X0 (Supply Services) 271X0 (Airport Air Operations)	9
General	204X0 (Intelligence Operations and Imagery Interpretation) 251X0 (Weather Forecaster)[B] 791X0 (Information Specialist)[C]	645X0 (Inventory Management, Materiel Facilities and Supply Systems) 902X0 (Medical Services) 981X0 (Dental and Preventive Dentistry Technician)[D]	571X0 (Fire Protection) 231X1 (Graphics) 231X2 (Still Photographic)	9
Electronics	316X0G (Missile Electronic Equipment Specialist)[E] 325X1 (Avonic Instrument Systems Specialist) 304X4 (Ground Radio Equipment Repair)	541X0/G (Missile Facilities) 542X0 (Electrician) 542X2 (Electrical Power Production)	423X0 (Aircraft Electrical Systems Specialist) 423X3 (Aircraft Fuel Systems Mechanic) 426X2 (Jet Engine Mechanics)	9
	11	12	12	35

*Missing cell—no task list available for additional career fields

Air Force Designations:
A. Carpentry Specialist and Masonry Specialist
B. Changed to Weather Specialist
C. Information/Historian and Radio/Television Boradcasting
D. Dental Specialist and Preventive Dentistry Specialist
E. Missile Electronic Equipment Specialist, G and H Shreds, Missile Systems Analyst, G Shred

Table 4-2

Air Force Base Sample

Air Base	Location	Function
Davis-Monthan	Arizona	SAC
Nellis	Nevada	TAC
Little Rock	Arkansas	TAC
Pope	North Carolina	TAC
Hurlburt	Florida	TAC
Bergstrom	Texas	TAC
K.I. Sawyer	Michigan	SAC
Grand Forks	North Dakota	SAC
Malmstrom	Montana	SAC
McGuire	New Jersey	MAC

Respondent Sample

The respondent sample selection was considered next. On the basis of the results of the pretest, both supervisor (E-6 and above) and subordinate (E-5 and below) job incumbents were selected for inclusion in the sample. Selection was from a central locator file. For the incumbents to be sampled at a base, the base was supplied with a list which contained the incumbents' names, grades, and career fields (in a numerical code). At the outset, the goal was to select a total of 15 supervisors and 15 subordinates in each career field. When a selected job incumbent was not available, the designated project officer at each base was requested to make an equivalent substitute. If an equivalent substitution could not be made, then a reasonable substitute having the same AFSC as the originally selected incumbent was requested. In some cases, substitution was not possible.

Task Sample

The task list included in the survey form for each career field was designed to be both representative of the tasks performed on the job and to be of a length which would not overburden the respondents in terms of the time required for completion. Completion time information was taken for each airman who participated in the pretest. On the basis of these data and a decision that about 2.5 to 3.0 hours represented the maximum length for any data collection session, a 60-task list length was selected. A random selection method was used to develop, for each career field, a list that would be representative of and generalizable to the total AFSC. A table of random numbers was used to complete the random selection process.

Tasks were selected from the task listing, provided by the OSRs, for the 5-skill level of each career field. Since the duty categories of supervision, planning, and training involve functions often assigned to high level, senior incumbents, tasks falling in these categories were not included in the sampling process. Each of the remaining tasks listed in the OSRs was numbered and a table of random numbers was used to identify those tasks for inclusion in the final list for a career field. Accordingly, each final task list consisted of a set of operational activities common to the AFSC in question.

A downstream problem that could result from the procedure was that if changes were introudced in the AFSC (between the time of development of the OSR and the present work), the final list could then consist of tasks which are no longer performed and are perhaps unfamiliar to some responding airmen. To accommodate the respondents who would, as a result, be unfamiliar with certain tasks, a "Don't Know" response was included in the response options.

Data Collection Instruments

Content of Data Collection Forms

As stated above, for this data collection effort, several modifications were made to the pretest forms on the basis of the pretest indications. Thses modifications involved wording changes made in the interest of improved clarity, the exclusion of the magnitude estimation scaling approach, the use of a "Don't Know" response category instead of the "N" (not performed in the squadron) response, and the extension of the category scale from five units to seven intervals.

The scale of values used in the final survey instruments ranged from "1" (very little), through "7" (very high), with the scale value "4" (moderate) anchoring the midpoint.[3] The scale was presented to the respondents in the survey form instructions and also on a card, which the respondents kept before them as they completed their form. Exhibit 4-1 presents the scale card used by the respondents when they completed the amount and the performance quality variability sections of the survey form.

The response sheets were identical for both parts of the form. The same format was used as was employed in the pretest. The 60 tasks were arranged vertically along the left side of a page, 20 tasks per page. The respondents had a total of 1,560 judgments to make: 60 tasks x 13 abilities x 2 survey form sections.

Demographic Information

The cover page of each data collection form was coded with the appropriate AFSC. The cover page also asked for the name, rank, squadron, and location of the airman completing the form. Additionally, the respondents indicated how long they have been in their career field and the number of years they have been in the Air Force.

Procedures

Preparatory Step

A letter of introduction prepared by Air Force Human Resources Laboratory, Brooks Air Force Base was forwarded to each base several weeks prior to the survey start. A copy of this letter is presented as Appendix F to this report.

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[3] The NR response ("ability is not required in duty performance") was entered as a zero in the subsequent data analyses.

Amount

DK - unfamiliar with the duty

NR - ability is not required in duty performance

1 - very little amount is required in duty performance

2 - little amount is required in duty performance

3 - some amount is required in duty performance

4 - moderate amount is required in duty performance

5 - much is required in duty performance

6 - high amount is required in duty performance

7 - very high amount is required in duty performance

Performance Quality Variability

DK - unfamiliar with the duty

NR - ability is not required in the performance of the duty

1 - quality of performance varies "very little" because of differences in this ability among current personnel

2 - quality of performance varies "little" because of differences in this ability among current personnel

3 - quality of performance varies "some" because of differences in this ability among current personnel

4 - quality of performance varies "moderately" because of differences in this ability among current personnel

5 - quality of performance varies "much" because of differences in this ability among current personnel

6 - quality of performance varies "highly" because of differences in this ability among current personnel

7 - quality of performance varies "very highly" because of differences in this ability among current personnel

Exhibit 4-1. Scales used for parts 1 and 2 of the data collection forms.

Within two weeks after the introductory letter was transmitted, the appropriate air base was contacted and arrangements were completed for the survey completion. Survey completion at each air base took from two to five days and the same procedures were employed as in the pretest. Data collection sessions were of the group administration nature and the sessions were scheduled at the convenience of the air bases involved.

Administrator Instructions

The same set of administrator instructions as used in the pretest were used in administering the final forms. The only change introduced was in the sixth point of step 6 (explain the respondent's task). This instruction read as follows:

> There are yellow cards contained in each booklet that have the scale values you are to use when making your judgments (demonstrate). The values range from 1 to 7. If you are of the opinion that a particular skill is not required in the performance of a task, then you would enter "NR" in the appropriate box (demonstrate). There is also a don't know response which you can use if you really do not know anything about the task. Use the "DK" response only if you know nothing about the task. Make every effort to enter a judgment, even if you don't perform the task yourself and never did. We are not interested in what you personally do on the job--only in what you know about the performance of the tasks on the list. Your knowledge of thses tasks could have come from your training, observation, or past performance. Try to respond in every instance with a scale value.

Demographic Description of Sample

Survey forms were completed by 808 airmen in 35 Air Force Specialty Codes (AFSCs) in four aptitude areas (mechanical, administrative, general, and electronics), sampled at 10 Air Force bases. The final sample represented 80% of the 1008 airmen identified for participation in the survey.

The percentage of completed survey forms from the 10 air bases ranged from 64 to 89 with a median of 77.50. With the exception of an "oversampling" in Carpentry and Masonry Specialist and the coincidence of actual size with requested sample size in Procurement Specialist, "undersampling" in the remaining 33 AFSCs ranged from 7 to 50 percent with a median of 22 percent.

The eight AFSCs in the mechanical aptitude area contributed 181 out of 808 (22%) airmen to the total sample; the nine AFSCs in the administrative aptitude area contributed 206 (25%) airmen to the total sample, the nine AFSCs in the general aptitude area contributed 203 (25%) airmen to the final sample; and nine AFSCs in the electronics area contributed 218 (27%) airmen to the final sample. Thus, the four aptitude areas were approximately equally represented in the total sample. Each of the four areas contributed about one quarter of the total final sample.

Supervisor Description

Three hundred and seventy supervisors (46%) participated in the final survey. The frequency of supervisors in the 35 AFSCs in the four aptitude areas together with median and modal coded number of years in an AFSC and years in the Air Force are reported in Table 4-3. The frequency of supervisors in the final sample ranged from 1 to 15 in an AFSC with a median of 11.14.

Number of years in an AFSC for supervisors was coded as follows:

1. Less than 1 year to 1 year.
2. More than 1 to 4 years.
3. More than 4 to 7 years.
4. More than 7 to 10 years.
5. More than 10 years.

The median of coded number of years (calculated from class intervals of scale values and converting to years, as indicated above) in an AFSC ranged from 2.25 (more than 1 to 4 years) to 5.00 (more than 10 years). In 25 (71%) of the AFSCs, the median number of years in an AFSC was more than 10 years. The modes of coded number of years in an AFSC ranged from 2.00 (more than 1 to 4 years) to 5.00 (more than 10 years). In 31 (89%) AFSCs, the mode of coded number of years in an AFSC was more than 10 years.

Number of years in the Air Force for supervisors was coded in a manner identical with the code for years in an AFSC. The median of coded number of years in the Air Force ranged from 4.00 (more than 7 to 10 years) to 5.00 (more than 10 years). In 33 (94%) AFSCs, the median of coded number of years in the Air Force was more than 10

Table 4-3

Frequency of Supervisors in the Final Sample in 35 AFSCs in Four Aptitude Areas with Median and Mode of Years in their Specialty (AFSC) and Years in the Air Force (AF)+

AFSC	n	Years in AFSC Mdn	Years in AFSC Mo	Years in AF Mdn	Years in AF Mo
Mechanical					
Munitions Maintenance	12	4.50	5.00	5.00	5.00
Weapons Mechanic	12	4.64	5.00	5.00	5.00
Air Passenger and Air Cargo Specialist	2	4.50	4.00;5.00	4.50	4.00;5.00
Aircraft Loadmaster	11	4.95	5.00	5.00	5.00
LGM 25 Missile Mechanic	13	2.75	2.00	5.00	5.00
Vehicle Operator/Dispatcher	11	4.58	5.00	4.81	5.00
Fuels Specialist	13	4.96	5.00	4.96	5.00
Carpentry and Masonry Specialist	1	4.00	4.00	4.00	4.00
Administrative					
Procurement Specialist	14	4.50	5.00	5.00	5.00
Chapel Management	11	4.71	5.00	4.95	5.00
Legal Services	12	4.00*	4.00*;5.00*	5.00*	5.00*
Radio Operator	2	5.00	5.00	5.00	5.00
Personnel	12	4.50	5.00	5.00	5.00
Air Traffic Control Operator Technician	10	4.94	5.00	5.00	5.00
Airman Administration	15	4.96	5.00	4.96	5.00
Supply Services	10	4.67	5.00	5.00	5.00
Airport Air Operations	10	4.60*	5.00*	4.99	5.00
General					
Intelligence Operations and Imagery Interpretation	8	4.93	5.00	4.93	5.00
Weather Forecaster	10	4.67	5.00	5.00	5.00
Information Specialist	9	3.25	5.00	5.00	5.00
Inventory Management, Materiels Facilities and Supply Systems	13	5.00	5.00	5.00	5.00
Medical Services	10	4.94	5.00	5.00	5.00
Dental and Preventive Dentistry Technician	11	4.89	5.00	4.95	5.00
Fire Protection	11	4.95	5.00	4.95	5.00
Graphics	8	4.83	5.00	5.00	5.00
Still Photographic	11	4.89	5.00	5.00	5.00
Electronics					
Missile Electronic Equipment Specialist	12	2.42*	2.00*	5.00	5.00
Missile Facilities	12	2.25	2.00	4.95	5.00
Aircraft Electrical Systems Specialist	14	4.92	5.00	4.92	5.00
Avionic Instrument Systems Specialist	12	4.95*	5.00*	5.00	5.00
Ground Radio Equipment Repair	9	4.93	5.00	5.00	5.00
Electrician	11	4.83	5.00	4.95	5.00
Electrical Power Production	8	4.83	5.00	5.00	5.00
Aircraft Fuel Systems Mechanic	15	4.82	5.00	4.96	5.00
Jet Engine Mechanic	15	5.00	5.00	5.00	5.00
Σn	370				

*One respondent did not check a category on the background cover sheet.

+Years in Air Force are necessarily more than years in specialty for a number of reasons.

years. Similarly the modes of coded number of years in the Air Force ranged from 4.00 to 5.00. In 34 (97%) AFSCs, the mode of coded number of years in the Air Force was more than 10 years.

Subordinate Description

In the final survey, 438 subordinates (54% of the total number of participants) participated. The frequency of subordinates in the 35 AFSCs in the four aptitude areas together with the median and mode of coded number of years in an AFSC and the years in the Air Force is reported in Table 4-4. The frequency of subordinates in the final sample ranged from 5 to 20 in an AFSC with a median of 12.08.

Number of years in an AFSC for subordinates was coded in a manner identical with the code for years in an AFSC for supervisors. The median of coded number of years in an AFSC ranged from 1.88 (more than 1 to 4 years) to 4.50 (more than 7 to 10 years). In 11 (31%) AFSCs, the median of coded number of years in an AFSC was more than 1 to 4 years. Similarly, the modes of coded number of years in an AFSC ranged from 2.00 (more than 1 to 4 years) to 5.00 (more than 10 years). In 21 (60%) AFSCs, the mode of coded number of years in an AFSC was more than 1 to 4 years.

Number of years in the Air Force for subordinates was coded in a manner identical with the code for years in an AFSC. The median of coded number of years in the Air Force ranged from 2.38 (more than 1 to 4 years) to 4.50 (more than 7 to 10 years). In 23 (67%) AFSCs, the median of coded number of years in the Air Force was more than 4 to 7 years. Similarly, the modes of coded number of years in the Air Force ranged from 2.00 (more than 1 to 4 years) to 5.00 (more than 10 years). In 13 (37%) AFSCs, the mode of coded number of years in the Air Force was more than 1 to 4 years and in 14 (40%) AFSCs the mode of coded number of years in the Air Force was more than 4 to 7 years.

Accordingly, the number of supervisors and subordinates in the final sample was approximately equal. But, as a group, the supervisors possessed more years than the subordinates in an AFSC and in the Air Force, as could be expected. Moreover, as a group, the supervisors were more homogeneous than the subordinates with respect to years in an AFSC and in the Air Force.

Except for Carpentry and Masonry Specialist, Air Passenger and Air Cargo Specialist, and Radio Operator, in 24 (69%) AFSCs the discrepancy between sample size of supervisors and subordinates did not exceed three airmen.

Table 4-4

Frequency of Subordinates in the Final Sample in 35 AFSCs in Four Aptitude Areas with Median and Mode of Years in their Specialty (AFSC) and Years in the Air Force (AF)⁺

		Years in AFSC		Years in AF	
AFSC	n	Mdn	Mo	Mdn	Mo
Mechanical					
Munitions Maintenance	14	2.67*	2.00*	2.67*	2.00*
Weapons Mechanic	15	2.80	2.00	2.83	2.00
Air Passenger and Air Cargo Specialist	11	2.38	2.00	2.38	2.00
Aircraft Loadmaster	11	2.63	2.00;3.00	3.25	3.00
LGM 25 Missile Mechanic	10	2.67	3.00	3.40*	3.00*
Vehicle Operator/Dispatcher	12	4.50	5.00	4.50	5.00
Fuels Specialist	13	3.71	4.00	3.71	4.00
Carpentry and Masonry Specialist	20	2.71*	2.00*;3.00*	2.83	3.00
Administrative					
Procurement Specialist	16	2.50	2.00;3.00	3.00	3.00
Chapel Management	11	2.67	2.00	3.00	2.00
Legal Services	14	1.93	2.00	4.17	5.00
Radio Operator	13	3.58	4.00	3.58	4.00
Personnel	13	3.25	2.00	3.67	5.00
Air Traffic Control Operator Technician	17	2.15	2.00	2.75	2.00
Airman Administration	10	3.00	2.00	3.25	3.00
Supply Services	11	3.33	3.00;5.00	4.00	5.00
Airport Air Operations	5	1.88	2.00	3.75	4.00
General					
Intelligence Operations and Imagery Interpretation	11	2.68	3.00	3.57	3.00;5.00
Weather Forecaster	11	2.81	3.00	2.92	2.00;3.00;4.00
Information Specialist	12	2.57	3.00	3.00	3.00
Inventory Management, Materiel Facilities and Supply Systems	15	3.40	4.00	3.75	4.00
Medical Services	11	2.92	3.00	3.00	3.00
Dental and Preventive Dentistry Technician	15	2.86	3.00	2.90*	2.00*;3.00*
Fire Protection	12	3.50	2.00;4.00	3.50	2.00;4.00
Graphics	11	2.40	2.00	2.80	3.00
Still Photographic	14	3.00	3.00	3.50	5.00
Electronics					
Missile Electronic Equipment Specialist	11	2.86	2.00	2.57	2.00
Missile Facilities	12	2.21	2.00	3.00	3.00
Aircraft Electrical Systems Specialist	14	2.50	2.00	2.67	2.00;3.00
Avonic Instrument Systems Specialist	11	3.08	3.00	3.08	4.00
Ground Radio Equipment Repair	12	2.50	2.00	2.83	2.00
Electrician	16	2.50	2.00	3.83	5.00
Electricial Power Production	13	3.00	2.00	3.00*	2.00*
Aircraft Fuel Systems Mechanic	12	2.50	2.00	2.50	2.00
Jet Engine Mechanic	9	3.00	3.00	3.13	3.00
Σn	438				

*One respondent did not check a category on the background cover sheet.

+Years in Air Force are necessarily more than years in specialty for a number of reasons.

Results

In the 35 AFSCs, 370 supervisors and 438 subordinates judged the amount of 13 perceptual/psychomotor ability classes relative to the performance of 60 tasks in their AFSC, on a seven-point rating scale. Altogether, 780 judgments were made by each airman in this aspect of the survey.

Taxonomic Class Means--Amount

The 60 judgments by a supervisor were summated for an ability and reduced to an arithmetic mean for each supervisor in the 35 AFSCs to generate an individual mean for each supervisor. Thirteen sets of individual means resulted for each supervisor in each of the 35 AFSCs. (The total number of individual means calculated was 4,810). These were further reduced to a group mean for the sampled supervisors in each AFSC. Thirteen sets of group means resulted for the supervisors in each of the 35 AFSCs. The total number of group means for supervisors calculated was (13 x 35) 455.

In a like manner individual means and group means of the amount of a perceptual/psychomotor ability by sampled subordinates were determined. There were 5,694 individual means and 455 group means calculated for subordinates.

Finally, the 60 judgments of amount of a perceptual/psychomotor ability by all supervisors and all subordinates in an AFSC were summated for an ability and reduced to a grand mean to generate a combined mean for supervisors and subordinates combined. The total number of such means calculated was 455. These means, combined for supervisors and subordinates are reported in Tables 4-5 through 4-8, according to the four aptitude areas.

The mean ratings reported in Tables 4-5 through 4-8 generally cluster about the low end of the seven-point rating scale. In 368 out of 455 (81%) of the instances, the combined mean is below 3.0, --"some" amount of the designated ability was judged to be involved in performing the tasks in an AFSC. This trend is consistent with the pretest findings.

In 416 out of 455 (91%) comparisons of the group means for sampled supervisors and the group means for sampled subordinates with respect to judgments of amount of the 13 perceptual/psychomotor abilities, differences of less than one point on the rating scale were found. Twenty out of 455 (4%) differences larger than one point on the rating scale clustered around visual memory, visual speed and accuracy, and position

Table 4-5

Means and SDs of Judgments Concerning Amount of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 8 AFSCs and in the Mechanical Aptitude Area

AFSC			FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CP	DP	DA	KM
Mechanical															
Munitions Maintenance	(26)	M	2.74	2.78	2.19	1.73	2.86	2.74	2.53	1.12	1.01	2.05	1.70	1.79	0.64
		SD	2.17	2.27	2.30	2.17	2.13	2.31	2.27	1.85	1.75	2.12	1.85	1.96	1.19
Weapons Mechanic	(27)	M	3.39	3.18	2.70	2.36	3.98	3.76	3.95	1.29	1.09	2.02	2.18	1.75	2.14
		SD	2.06	1.93	1.99	2.06	1.97	2.04	2.03	1.71	1.54	2.11	1.90	1.66	2.08
Air Passenger and Air Cargo Specialist	(13)	M	3.26	3.03	2.85	2.45	3.34	3.01	2.96	2.17	1.73	2.58	2.14	2.46	1.74
		SD	2.04	2.19	2.21	2.13	2.12	2.20	2.07	2.32	1.90	2.42	2.15	2.33	1.88
Aircraft Loadmaster	(22)	M	2.84	2.31	1.77	1.54	3.26	2.90	3.31	1.28	1.18	1.83	1.34	1.91	1.26
		SD	2.11	2.13	1.98	1.94	2.42	2.36	2.36	1.95	1.87	2.30	2.01	2.11	1.89
LGM 25 Missile Mechanic	(23)	M	2.99	3.07	2.23	1.56	2.64	2.8[illegible]	3.02	0.70	0.71	1.10	1.60	1.43	1.75
		SD	2.15	2.06	2.16	1.95	1.97	2.30	2.31	1.34	1.35	1.70	2.00	1.78	2.01
Vehicle Operator/ Dispatcher	(23)	M	3.26	2.94	2.68	2.39	3.22	2.62	3.02	2.09	1.84	2.62	2.30	2.52	1.84
		SD	2.16	2.19	2.31	2.29	2.19	2.11	2.11	2.22	2.10	2.22	2.33	2.14	2.09
Fuels Specialist	(26)	M	1.95	1.86	1.73	1.42	2.42	2.06	2.04	1.34	1.06	2.06	1.18	2.08	1.15
		SD	1.67	1.69	1.74	1.63	1.79	1.81	1.79	2.03	1.84	2.32	1.83	2.14	1.90
Carpentry and Masonry Specialist	(21)	M	2.90	3.14	1.77	1.75	2.74	2.56	2.61	0.87	0.61	1.45	1.41	1.66	1.50
		SD	2.51	2.47	2.15	2.15	2.35	2.24	2.37	1.31	0.96	1.81	2.01	1.80	1.97
Aptitude Area Summary	(181)	M	3.08	2.97	2.29	1.93	3.24	2.99	3.11	1.30	1.11	1.92	1.64	1.91	1.49
		SD	2.21	2.19	2.20	2.14	2.23	2.29	2.30	1.89	1.72	2.17	2.04	2.00	1.95

Note: Frequencies in parentheses indicate sample size (supervisors and subordinates) in an AFSC.

Table 4-6

Means and SDs of Judgments Concerning Amount of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the Administrative Aptitude Area

AFSC			FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CP	DP	DA	KM
Administrative															
Procurement Specialist	(30)	M	1.85	1.57	0.67	0.65	3.01	1.86	1.47	0.52	0.53	3.04	0.56	1.60	0.40
		SD	1.77	1.64	1.31	1.35	2.23	2.31	2.05	1.45	1.46	2.48	1.28	2.21	1.13
Chapel Management	(22)	M	3.10	2.26	1.34	0.75	2.60	2.08	2.25	0.67	0.71	1.79	0.73	1.07	0.51
		SD	2.22	1.88	1.85	1.25	2.16	2.23	2.16	1.28	1.31	2.16	1.26	1.34	0.97
Legal Services	(26)	M	3.73	2.51	1.61	0.80	2.85	1.83	1.81	0.40	0.40	3.17	0.39	1.30	0.67
		SD	2.54	2.11	2.08	1.56	2.47	2.34	2.04	1.11	1.17	2.64	0.84	2.05	1.48
Radio Operator	(15)	M	2.51	2.39	2.58	1.34	2.69	2.78	3.26	3.15	2.68	2.54	1.66	2.47	1.48
		SD	2.17	2.24	2.39	1.75	2.32	2.41	2.55	2.82	2.74	2.50	2.30	2.50	2.05
Personnel	(25)	M	3.45	2.39	1.58	1.14	3.52	3.20	2.70	0.44	0.42	3.73	0.55	1.25	0.52
		SD	2.27	1.86	2.12	1.85	2.35	2.46	2.52	1.05	1.08	2.53	1.17	1.83	1.10
Air Traffic Control Operator Technician	(27)	M	2.01	1.73	1.60	2.01	3.54	2.98	3.40	2.11	1.60	1.83	2.61	3.80	1.39
		SD	1.85	1.72	1.72	2.13	2.45	2.43	2.56	2.29	2.03	2.05	2.64	2.63	1.84
Airman Administration	(25)	M	3.24	2.69	1.89	1.46	2.59	2.23	2.09	0.38	0.31	2.68	0.78	1.38	0.79
		SD	2.27	2.05	2.15	1.93	2.24	2.09	2.04	1.19	1.09	2.49	1.54	1.86	1.47
Supply Services	(21)	M	3.13	2.75	1.63	1.77	2.78	2.65	2.65	1.06	0.97	2.14	1.33	2.15	1.37
		SD	2.44	2.28	1.97	2.11	2.37	2.51	2.47	1.51	1.63	2.38	1.93	2.49	2.07
Airport Air Operations	(15)	M	2.20	1.95	0.92	0.21	1.74	1.76	1.15	0.65	0.46	2.80	0.36	1.24	0.18
		SD	2.32	2.19	1.73	0.68	2.32	2.40	1.98	1.84	1.52	2.66	1.19	2.12	1.20
Aptitude Area Summary	(206)	M	2.79	2.20	1.47	1.13	2.90	2.37	2.29	0.96	0.83	2.66	0.99	1.82	0.79
		SD	2.30	2.00	1.96	1.78	2.38	2.41	2.38	1.83	1.70	2.51	1.80	2.31	1.53

Note: Frequencies in parentheses indicate sample size (supervisors and subordinates) in an AFSC.

Table 4-7

Means and SDs of Judgments Concerning Amount of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the General Aptitude Area

AFSC			FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CP	DP	DA	KM
General															
Intelligence Operation and Imagery Interpretation	(19)	M	2.66	2.33	1.09	0.69	3.00	2.55	2.35	0.27	0.24	2.67	0.85	1.27	0.26
		SD	2.37	2.24	1.77	1.49	2.58	2.57	2.53	0.85	0.87	2.64	1.79	1.92	0.78
Weather Forecaster	(21)	M	2.94	2.32	1.18	0.82	4.23	4.12	3.56	0.39	0.46	4.47	1.43	3.91	0.69
		SD	2.47	2.22	1.99	1.52	2.63	2.73	2.81	1.01	1.22	2.69	2.33	2.90	1.53
Information Specialist	(21)	M	2.76	2.37	0.97	0.81	3.12	2.49	2.05	0.91	0.88	3.14	0.69	1.59	0.79
		SD	2.33	2.09	1.37	1.17	2.70	2.57	2.23	1.81	1.75	2.55	1.15	2.46	1.73
Inventory Management, Materiel Facilities and Supply Systems	(28)	M	2.72	2.25	1.35	0.97	2.47	2.27	2.60	0.37	0.29	3.08	0.39	1.34	0.47
		SD	1.95	1.88	1.87	1.56	2.13	2.10	2.12	1.03	0.85	2.42	0.99	1.93	0.98
Medical Services	(21)	M	2.84	3.01	1.90	1.38	3.17	2.37	2.71	1.18	1.08	2.14	1.15	1.68	1.13
		SD	2.17	2.22	2.23	1.97	2.30	2.47	2.47	2.04	1.98	2.42	2.01	2.22	2.02
Dental and Preventive Dentistry Technician	(26)	M	3.29	3.27	1.73	1.15	2.79	2.57	2.57	0.64	0.46	1.31	1.17	0.98	0.90
		SD	2.08	1.97	2.06	1.69	2.42	2.38	2.30	1.32	1.06	1.93	1.78	1.49	1.49
Fire Protection	(23)	M	2.94	3.20	2.61	2.39	3.08	2.73	3.07	1.81	1.39	1.54	1.81	2.28	1.94
		SD	2.16	2.25	2.39	2.41	2.30	2.46	2.38	2.20	1.94	1.96	2.09	2.27	2.22
Graphics	(19)	M	3.91	3.69	1.39	0.91	3.52	2.59	2.35	0.17	0.14	2.38	1.57	1.11	0.90
		SD	2.35	2.31	2.15	1.61	2.44	2.43	2.32	0.71	0.59	2.64	2.35	1.78	1.88
Still Photographic	(25)	M	3.05	3.16	2.52	1.55	3.60	3.00	3.09	1.09	0.75	1.78	1.40	1.51	1.35
		SD	2.28	2.28	2.32	2.07	2.23	2.36	2.46	1.83	1.63	2.24	2.07	2.02	2.18
Aptitude Area Summary	(203)	M	3.00	2.86	1.69	1.22	3.17	2.70	2.70	0.79	0.65	2.41	1.14	1.68	0.96
		SD	2.25	2.21	2.13	1.85	2.44	2.48	2.42	1.63	1.47	2.53	1.90	2.25	1.79

Note: Frequencies in parentheses indicate sample size (supervisors and subordinates) in an AFSC.

Table 4-8

Means and SDs of Judgments Concerning Amount of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the Electronics Aptitude Area

FSC			FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CP	DP	DA	KM
Electronics															
Missile Electronic Equipment Specialist	(23)	M	2.04	1.95	1.67	1.40	1.85	1.87	1.75	1.18	0.97	1.58	1.12	0.89	0.87
		SD	1.73	1.67	1.69	1.76	1.75	1.83	1.75	1.83	1.53	1.95	1.33	1.20	1.13
Missile Facilities	(24)	M	3.52	3.08	2.42	1.00	3.52	3.08	2.42	1.00	1.01	1.39	1.35	1.50	1.29
		SD	2.12	2.13	2.31	1.48	2.12	2.13	2.31	1.48	1.59	2.02	1.63	1.75	1.68
Aircraft Electrical Systems Specialist	(28)	M	3.37	3.15	2.59	1.50	3.37	3.15	2.59	1.50	1.28	2.47	1.71	1.44	2.27
		SD	2.08	2.03	1.99	1.60	2.08	2.03	1.99	1.60	1.66	2.03	1.78	1.61	2.31
Avionic Instrument Systems Specialist	(23)	M	3.96	3.91	3.53	2.17	3.96	3.91	3.53	2.17	1.17	2.93	1.92	2.18	2.57
		SD	2.27	2.25	2.48	2.46	2.27	2.25	2.48	2.46	1.90	2.69	1.90	2.15	2.59
Ground Radio Equipment Repair	(21)	M	3.22	3.41	2.98	1.77	3.70	3.32	3.26	1.92	1.56	2.09	1.59	2.11	2.02
		SD	2.32	2.29	2.31	1.78	2.30	2.32	2.26	2.04	1.77	2.00	1.48	1.92	1.91
Electrician	(27)	M	3.60	3.76	2.35	1.72	3.62	2.94	3.23	0.91	0.69	1.16	1.81	1.09	1.50
		SD	1.98	1.98	2.05	1.90	2.08	2.29	2.29	1.49	1.30	1.71	2.05	1.46	1.94
Electrical Power Production	(21)	M	2.96	2.90	2.47	1.30	3.16	2.59	3.06	0.85	0.73	0.86	0.68	0.77	0.97
		SD	2.03	2.02	2.11	1.92	2.10	2.03	2.13	1.42	1.36	1.49	1.24	1.40	1.66
Aircraft Fuel Systems Mechanic	(27)	M	3.16	2.96	1.89	1.23	3.24	2.66	3.16	0.99	0.84	1.37	1.26	1.23	1.70
		SD	2.07	2.07	1.91	1.47	2.28	2.23	2.27	1.48	1.42	1.78	1.72	1.63	2.01
Jet Engine Mechanic	(24)	M	3.15	2.96	2.20	1.52	3.44	3.41	3.38	1.19	1.16	1.85	1.31	1.53	1.54
		SD	2.11	2.00	2.04	1.71	2.22	2.27	2.27	1.81	1.74	1.99	1.69	1.78	1.95
Aptitude Area Summary	(218)	M	3.28	3.20	2.45	1.51	3.34	3.14	3.33	1.28	1.05	1.74	1.44	1.42	1.65
			2.10	2.09	2.15	1.80	2.21	2.31	2.31	1.82	1.64	2.08	1.73	1.74	2.03
GRAND MEAN (Tables 4-5 through 4-8)		M	3.00	2.78	1.96	1.42	3.10	2.73	2.71	1.11	0.93	2.22	1.30	1.72	1.21

Note: Frequencies in parentheses indicate sample size (supervisors and subordinates) in an AFSC.

memory across the 35 AFSCs. The use of combined means for supervisors and subordinates, instead of individual group means was indicated by the pretest results and further supported by the present data.

In 51 out of 52 (98%) comparisons, aptitude area means for each ability separately differed from one another by less than one point on the rating scale. For 48 out of 52 (92%) of the aptitude area means, the obtained values were less than 2.00.

Taxonomic Class Standard Deviations--Amount

A standard deviation (SD) was also determined as a summary index of variability/scatter of the judgments of the amount of each perceptual/psychomotor ability over the 60 tasks in the supervisor and subordinate subsamples separately in each AFSC. That is to say, the 60 judgments by all supervisors in an AFSC were summated for an ability and reduced to an SD to generate a group SD for the sampled supervisors in an AFSC. Thirteen sets of group SDs resulted for the supervisors in each of the 35 AFSCs. An identical variability determination was made for the sampled subordinates in each AFSC. Thirteen sets of group SDs resulted for the subordinates in each of the 35 AFSCs. For each subsample, therefore, 455 group SDs were calculated.

Finally, the 60 judgments of amount of a perceptual/psychomotor ability by all supervisors and all subordinates in an AFSC were summated for each ability and reduced to generate a SD combined for supervisors and subordinates. The total number of such SDs calculated was 455. These SDs combined for sampled supervisors and sampled subordinates are included in Tables 4-5 through 4-8 according to the four aptitude areas.

As in the pretest, the subordinates in the 35 AFSCs were characteristically more variable than supervisors in their judgments of amount of 13 perceptual/psychomotor abilities in the performance of assigned tasks in an AFSC. Thus, in 12 out of 455 (3%) comparisons of the group supervisor and group subordinate SDs, subordinates exceeded supervisors by less than one point on the rating scale, in 183 out of 455 (40%) comparisons, between one and two points on the rating scale, and, in 260 (57%) comparisons, by more than two points on the rating scale. It is possible that this finding may be due to the heterogeneity of the backgrounds of the sample subordinates in terms of years in an AFSC and in the Air Force, as compared to the relative uniformity of the backgrounds of the supervisors on these dimensions. The subordinates, as a group, it could be surmised, may lack a common frame of reference or a firm base for veridical judgments. Ability and motivational variables, too, may account for the observed differences.

Within the administrative, general, and electronics aptitude areas, all aptitude area SDs differed from one another by less than one point on the rating scale; and, in the mechanical aptitude area, 3 out of 13 (23%) aptitude area SDs differed by more than one-point on the rating scale. Within the same three aptitude areas, 23 out of 39 (59%) of the aptitude area SDs were larger than 2.00, and in the fourth, 10 out of 13 (77%) of the aptitude area SDs were so.

"High" and "Low" Ability Requirements

The combined means of judgments of the amount of the 13 individual perceptual/psychomotor abilities by all sampled supervisors and subordinates within an AFSC were compared with the AFSC mean across all abilities. If an individual mean deviated from the AFSC mean across abilities by at least one SD unit above the AFSC mean, it was inferred that the sampled airmen judged the tasks in an AFSC to require a relatively "high" amount of the individual perceptual/psychomotor abilities on the performance of its tasks. If an ability mean deviated from the across-ability mean by at least one SD unit below the AFSC mean, it was inferred that the sampled airmen judged the tasks in an AFSC to require a relatively "low" amount of the individual ability on the performance of its tasks. These relatively "high" and relatively "low" judgments of amount of 13 perceptual/psychomotor abilities are reported for 29 AFSCs in Table 4-9 according to the four aptitude areas. For six AFSCs no ability met the plus or minus one SD criterion: Mechanical--Munitions Maintenance, Air Passenger and Air Cargo Specialist, Vehicle Operator/Dispatcher; Administrative--Radio Operator, and General--Fire Protection.

Distinctive patterns of perceptual/psychomotor abilities emerged as associated with the performance of assigned tasks in most AFSCs. Because of overlap of relatively "high" amounts of judged specific abilities within and between the four aptitude areas (like visual memory and finger dexterity in each of the four aptitude areas and clerical perception in the administrative and general aptitude areas and position memory both in the mechanical and electronics aptitude areas) the pattern of perceptual/psychomotor abilities associated with the performance of assigned tasks assumes some importance. Moreover, the patterns listed in Table 4-9 seem to be in common sense accord with actual job requirements. For example, visual memory and divided attention would be expected in an Air Traffic Control Operator; finger dexterity and manual dexterity in a Dental and Preventive Dentistry Technician; finger dexterity, manual dexterity, control precision, visual memory, visual speed and accuracy, and position memory in a Ground Radio Equipment Repair Specialist; and, finger dexterity, visual memory,

Table 4-9

"High" and "Low" Amount of 13 Perceptual/Psychomotor Abilities in 29 AFSCs by Aptitude Areas

AFSC	High	Low
Mechanical		
Weapons Mechanic	Finger Dexterity; Visual Memory; Visual Speed and Accuracy; Position Memory	Auditory Discrimination; Auditory Memory
Aircraft Loadmaster	Visual Memory; Position Memory	
LGM 25 Missile Mechanic	Manual Dexterity; Position Memory	Auditory Discrimination; Auditory Memory
Fuels Specialist	Visual Memory	Auditory Memory
Carpentry and Masonry Specialist	Manual Dexterity	Auditory Memory
Administrative		
Procurement Specialist	Visual Memory; Clerical Perception	
Chapel Management	Finger Dexterity; Visual Memory	Kinesthetic Memory
Legal Services	Finger Dexterity; Visual Memory; Clerical Perception	Auditory Discrimination; Auditory Memory; Depth Perception
Personnel	Finger Dexterity; Visual Memory; Visual Speed and Accuracy; Clerical Perception	Auditory Discrimination; Auditory Memory; Depth Perception; Kinesthetic Memory
Air Traffic Control Operator Technician	Visual Memory; Divided Attention	
Airman Administration	Finger Dexterity	Auditory Discrimination; Auditory Memory
Airport Air Operations	Clerical Perception	

Table 4-9 (cont.)

AFSC	High	Low
General		
Intelligence Operations and Imagery Interpretation		Auditory Discrimination; Auditory Memory; Kinesthetic Memory
Weather Forecaster	Visual Speed and Accuracy; Clerical Perception; Divided Attention	Rate Control; Auditory Discrimination; Auditory Memory; Kinesthetic Memory
Information Specialist	Visual Memory; Clerical Perception	
Inventory Management, Materiel Facilities and Supply Systems	Finger Dexterity; Position Memory; Clerical Perception	Auditory Discrimination; Auditory Memory; Depth Perception; Kinesthetic Memory
Medical Services	Visual Memory	
Dental and Preventive Dentistry Technician	Finger Dexterity; Manual Dexterity	Auditory Discrimination; Auditory Memory
Graphics	Finger Dexterity; Manual Dexterity Visual Memory	Auditory Discrimination; Auditory Memory
Still Photographics	Visual Memory	Auditory Memory
Electronics		
Missile Electronic Equipment Specialist	Manual Dexterity	
Missile Facilities	Finger Dexterity; Position Memory	Rate Control; Auditory Memory
Aircraft Electrical Systems Specialist	Visual Memory; Visual Speed and Accuracy; Position Memory	Auditory Memory; Divided Attention
Avionic Instrument Systems Specialist		Auditory Discrimination; Auditory Memory
Ground Radio Equipment Repair	Finger Dexterity; Manual Dexterity; Control Precision; Visual Memory; Visual Speed and Accuracy; Position Memory	
Electrician	Finger Dexterity; Manual Dexterity; Visual Memory	Auditory Discrimination; Auditory Memory; Divided Attention
Electrical Power Production	Finger Dexterity; Manual Dexterity; Position Memory	Depth Perception
Aircraft Fuel Systems Mechanic	Finger Dexterity; Manual Dexterity; Position Memory	Auditory Discrimination; Auditory Memory
Jet Engine Mechanic	Visual Memory; Visual Speed and Accuracy; Position Memory	

visual speed and accuracy, and position memory in a Weapons Mechanic. Other examples, like Weather Forecaster, Personnel Specialist, Jet Engine Mechanic, and Aircraft Loadmaster patterns of perceptual/psychomotor abilities support a correspondence between the judgments of these abilities and actual requirements "on the job" scene. Accordingly, a pattern of perceptual/psychomotor abilities, taken with other indices of cognitive and personality factors, could be decisive for personnel assignments.

With respect to the relatively "low" amounts of judged specific perceptual/psychomotor abilities among the four aptitude areas, auditory discrimination and auditory memory were consistently judged as having "little" or "very little" involvement in task performance within and between AFSCs in the four aptitude areas. Kinesthetic memory, too, was generally minimized in the administrative and general aptitude areas--in accord with logical expectations. In a similar fashion, depth perception cannot be expected in Legal Services and in Inventory Management, Materiel Facilities, and Supply Systems. As for the patterns of relatively "high" amounts of judged specific perceptual/psychomotor abilities, patterns of relatively "low" amounts of judged abilities can be useful in personnel classification. The "low" and "high" patterns, integrated into a unit for personnel classification, should improve the probability of reducing the incidence of assigning to a specialty persons with abilities not required by that specialty.

Across all AFSCs, Table 4-9 indicates the four abilities most required are: visual memory, visual speed and accuracy, finger dexterity, and manual dexterity. The four least required are: auditory memory, auditory discrimination, kinesthetic memory, and depth perception.

Taxonomic Class Means--Performance Quality Variability

Each of the airmen judged the performance quality variability as a function of the 13 perceptual/psychomotor abilities separately for each of 60 tasks proper for duty performance in their assigned AFSC. Altogether, 780 judgments were made by each airman during this phase of the survey.

Individual means for supervisors and for subordinates, group means for supervisors and subordinates, as well as combined means for supervisors and subordinates were calculated for the 60 judgments of performance quality variability as a function of each of the 13 perceptual/psychomotor abilities in the 35 AFSCs. As previously, there were 5,694 individual means, 455 group means, and 455 combined means. The combined means for all sampled supervisors and all sampled subordinates in an AFSC are presented in Tables 4-10 through 4-13 according to the four aptitude areas.

Differences of less than one point on the rating scale were found in 438 (96%) comparisons of the group means for supervisors and the group means for subordinates with respect to judgments of performance quality variability as a function of the 13 perceptual/psychomotor abilities. Eleven (2%) differences larger than one point on the rating scale clustered around visual memory, visual speed and accuracy, and position memory across the 35 AFSCs. The use of combined means for supervisors and subordinates, instead of a mean for supervisors and a mean for subordinates in Tables 4-10 through 4-13, therefore, was again believed to be supported.

Group SDs and combined SDs for all sampled supervisors were similarly calculated. The combined SDs for all sampled supervisors and all sampled subordinates in an AFSC are reported in Tables 4-10 through 4-13 according to the four aptitude areas.

As previously, the subordinates in the 35 AFSCs were characteristically more variable than were the supervisors in their judgments of performance quality variability as a function of the 13 perceptual/psychomotor abilities in the performance of assigned tasks in an AFSC. In 22 out of 455 (5%) comparisons of the group supervisor and group subordinate SDs, subordinates exceeded supervisors by less than one point on the rating scale; in 299 out of 455 (66%) comparisons, between one and two points on the rating scale; and in 134 out of 455 (29%) comparisons, by more than two points on the rating scale.

Aptitude area means and SDs were also computed for judgments of performance quality variability as a function of the 13 perceptual/psychomotor abilities in the performance of assigned tasks in an AFSC, as described for the determination of aptitude area means and SDs for judgments of amount of each ability in the preceding section. The aptitude area means and SDs are also reported in Tables 4-10 through 4-13.

In all 52 (100%) comparisons, aptitude area means for each ability separately differed from one another by less than one point on the rating scale. Thirty-three out of 52 (63%) of the aptitude area means were less than 2.00.

It was also noted that all aptitude area performance quality variability SDs differed from one another by less than one point on the rating scale. In nine out of 52 (17%) comparisons, the aptitude area SD was larger than 2.00.

Table 4-10

Means and SDs of Judgments Concerning Performance Quality Variabilities as a Function of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 8 AFSCs and in the Mechanical Aptitude Area

AFSC			FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CP	DP	DA	KM
Mechanical															
Munitions Maintenance	(26)	M	2.00	2.12	1.54	1.10	2.18	1.86	1.90	0.94	0.89	1.55	0.90	1.30	0.76
		SD	1.68	1.80	1.82	1.61	1.80	1.72	1.89	1.64	1.61	1.77	1.57	1.74	1.42
Weapons Mechanic	(27)	M	2.42	2.38	2.16	2.04	2.67	2.72	2.67	1.17	1.09	1.53	1.97	1.73	1.67
		SD	1.74	1.63	1.59	1.67	1.75	1.78	1.88	1.49	1.43	1.58	1.64	1.64	1.65
Air Passenger and Air Cargo Specialist	(13)	M	2.64	2.46	2.43	2.47	2.98	3.13	2.26	1.91	2.06	2.24	2.02	2.07	1.97
		SD	1.91	1.88	2.02	2.06	2.11	2.26	2.03	1.98	2.18	2.03	2.07	1.99	2.09
Aircraft Loadmaster	(22)	M	2.26	2.31	1.89	1.72	2.44	2.31	2.07	1.32	1.07	1.65	1.32	1.73	1.04
		SD	2.00	1.83	1.95	1.96	2.06	2.08	2.31	1.87	1.86	2.11	1.86	1.98	1.81
LGM 25 Missile Mechanic	(23)	M	1.99	2.31	1.77	1.53	2.15	2.04	2.08	0.90	0.85	1.02	1.48	1.19	1.70
		SD	1.63	1.79	1.58	1.55	1.73	1.75	1.74	1.46	1.46	1.48	1.74	1.48	1.69
Vehicle Operator/ Dispatcher	(23)	M	2.77	2.62	2.50	2.17	2.60	2.42	2.71	1.75	1.70	2.43	1.98	2.48	1.78
		SD	2.09	2.08	2.25	2.19	2.11	2.06	2.14	2.09	2.03	2.19	2.22	2.18	2.20
Fuels Specialist	(26)	M	1.95	1.86	1.73	1.42	2.42	2.06	2.04	1.05	1.05	1.56	1.02	1.65	1.01
		SD	1.67	1.69	1.74	1.63	1.79	1.81	1.79	1.61	1.59	1.68	1.51	1.77	1.71
Carpentry and Masonry Specialist	(21)	M	3.01	3.20	2.31	2.01	2.84	2.59	2.58	1.12	0.94	1.67	1.16	1.57	1.51
		SD	2.37	2.25	2.14	2.16	2.17	2.17	2.15	1.77	1.67	2.02	1.76	1.95	2.07
Aptitude Area Summary	(181)	M	2.36	2.40	2.01	1.77	2.35	2.30	2.24	1.23	1.15	1.67	1.45	1.69	1.39
		SD	1.93	1.91	1.91	1.89	1.93	1.99	1.97	1.76	1.75	1.90	1.83	1.88	1.87

Note: Frequencies in parentheses indicate sample size (supervisors and subordinates) in an AFSC.

Table 4-11

Means and SDs of Judgments Concerning Performance Quality Variabilities as a Function of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the Administrative Aptitude Area

AFSC			FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CP	DP	DA	KM
Administrative															
Procurement Specialist	(30)	M	1.45	1.28	0.66	0.54	2.50	1.64	1.00	0.35	0.33	2.50	0.45	1.39	0.24
		SD	1.62	1.49	1.34	1.23	1.96	1.91	1.55	1.04	1.03	2.15	1.13	2.07	0.80
Chapel Management	(22)	M	2.10	1.69	1.18	0.73	2.23	1.63	1.84	0.63	0.56	1.60	0.68	1.45	0.52
		SD	1.90	1.53	1.52	1.13	2.01	1.84	1.82	1.18	1.15	1.95	1.28	1.93	1.05
Legal Services	(26)	M	2.72	2.06	1.32	0.65	2.42	1.59	1.59	0.36	0.36	2.52	0.34	0.96	0.56
		SD	2.17	1.95	1.75	1.23	2.18	2.00	1.95	1.02	1.01	2.19	0.72	1.69	1.35
Radio Operator	(15)	M	1.90	2.04	1.89	1.33	1.80	1.70	1.87	1.67	1.53	1.74	1.13	1.60	1.42
		SD	1.83	1.98	1.92	1.65	1.82	1.85	1.97	1.94	1.75	1.78	1.41	1.65	1.58
Personnel	(25)	M	2.58	1.87	1.52	0.97	2.81	2.59	1.93	0.49	0.54	3.07	0.59	1.11	0.57
		SD	1.98	1.76	1.89	1.74	2.26	2.26	2.03	1.11	1.24	2.31	1.15	1.59	1.16
Air Traffic Control Operator Technician	(27)	M	1.49	1.40	1.44	1.54	2.83	2.59	2.55	1.91	1.57	1.62	2.11	2.94	1.12
		SD	1.34	1.34	1.46	1.75	2.21	2.27	2.18	2.26	2.07	1.96	2.26	2.45	1.54
Airman Administration	(25)	M	1.96	1.80	1.42	1.22	2.17	1.84	1.76	0.27	0.27	2.24	0.65	1.22	0.48
		SD	1.92	1.70	1.55	1.40	1.87	1.82	1.75	0.69	0.66	2.11	1.20	1.56	0.96
Supply Services	(21)	M	2.42	2.28	1.42	1.62	2.48	2.53	2.49	1.05	1.13	2.18	1.25	2.14	1.34
		SD	2.32	2.21	1.85	2.08	2.39	2.47	2.54	1.73	1.89	2.37	2.00	2.46	2.15
Airport Air Operations	(15)	M	1.42	1.23	0.92	0.31	1.49	1.23	1.02	0.37	0.31	1.67	0.30	0.84	0.15
		SD	1.91	1.91	1.77	0.82	2.22	2.04	1.79	0.92	0.99	1.97	0.79	1.47	0.50
Aptitude Area Summary	(206)	M	2.01	1.72	1.27	0.97	2.39	1.96	1.78	0.76	0.71	2.18	0.83	1.54	0.68
		SD	1.95	1.78	1.69	1.55	2.15	2.12	2.03	1.52	1.46	2.17	1.53	2.05	1.36

Note: Frequencies in parentheses indicate sample size (supervisors and subordinates) in an AFSC.

Table 4-12

Means and SDs of Judgments Concerning Performance Quality Variabilities as a Function of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the General Aptitude Area

AFSC			FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CP	DP	DA	KM
General															
Intelligence Operations and Imagery Interpretation	(19)	M	1.82	1.56	0.63	0.50	2.12	1.56	1.59	0.21	0.23	1.83	0.66	1.14	0.29
		SD	1.80	1.61	1.22	1.06	2.21	2.03	1.97	0.76	0.86	2.09	1.41	1.73	0.76
Weather Forecaster	(21)	M	2.30	1.87	0.71	0.76	3.79	3.50	2.98	0.41	0.46	3.67	1.25	3.64	0.80
		SD	2.34	2.02	1.11	1.25	2.54	2.67	2.26	0.74	0.87	2.63	2.11	2.73	1.54
Information Specialist	(21)	M	1.69	1.46	0.95	0.84	2.39	1.74	1.55	0.71	0.72	2.18	0.63	1.26	0.52
		SD	1.76	1.69	1.43	1.31	2.40	2.20	2.03	1.57	1.62	2.36	1.27	2.04	0.93
Inventory Management, Materiel Facilities and Supply Systems	(28)	M	1.96	1.88	1.01	0.75	2.02	1.59	1.66	0.32	0.32	2.34	0.34	1.19	0.34
		SD	1.54	1.39	1.32	1.22	1.82	1.75	1.68	0.86	0.86	1.94	0.89	1.63	0.74
Medical Services	(21)	M	2.01	2.38	1.69	1.31	2.83	2.40	2.44	1.20	1.10	2.04	1.08	1.70	1.15
		SD	1.86	2.12	2.07	1.94	2.34	2.31	2.34	2.09	2.03	2.35	1.93	2.30	1.90
Dental and Preventive Dentistry Technician	(26)	M	2.72	2.70	1.87	1.40	2.59	2.26	2.13	0.61	0.58	1.53	1.26	1.05	0.85
		SD	2.13	2.12	2.07	1.87	2.41	2.37	2.37	1.34	1.23	2.16	1.91	1.84	1.38
Fire Protection	(23)	M	2.08	2.40	2.11	1.99	2.34	2.16	2.30	1.44	1.39	1.54	1.57	1.93	1.59
		SD	1.91	2.01	2.06	2.03	1.93	2.12	2.03	1.67	1.70	1.96	1.76	1.97	1.83
Graphics	(19)	M	2.66	2.27	0.93	0.94	2.34	1.75	1.70	0.10	0.11	1.38	1.10	0.68	0.74
		SD	2.17	2.06	1.46	1.67	2.05	2.06	1.98	0.45	0.45	1.91	1.98	1.44	1.69
Still Photographic	(25)	M	2.34	2.40	1.99	1.44	2.65	2.06	2.11	0.88	0.74	1.47	1.27	1.30	1.28
		SD	2.04	2.02	2.15	1.98	2.20	2.08	2.16	1.69	1.58	2.01	2.00	1.92	2.16
Aptitude Area Summary	(203)	M	2.18	2.13	1.39	1.14	2.53	2.08	2.04	0.68	0.65	1.96	1.01	1.49	0.86
		SD	1.97	1.95	1.82	1.71	2.25	2.23	2.17	1.44	1.41	2.23	1.76	2.10	1.58

Note: Frequencies in parentheses indicate sample size (supervisors and subordinates) in an AFSC.

Table 4-13

Means and SDs of Judgments Concerning Performance Quality Variabilities as a Function of 13 Perceptual/Psychomotor Abilities Combined for Supervisors and Subordinates in 9 AFSCs and in the Electronics Aptitude Area

AFSC			FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CP	DP	DA	KM
Electronics															
Missile Electronic Equipment Specialist	(23)	M	2.04	1.95	1.67	1.40	1.85	1.87	1.75	1.13	1.07	1.47	0.92	0.87	1.21
		SD	1.73	1.67	1.69	1.76	1.75	1.83	1.75	1.76	1.69	1.79	1.05	1.03	1.73
Missile Facilities	(24)	M	2.06	2.17	1.70	0.99	1.59	1.86	1.69	1.28	0.86	1.19	1.17	1.13	1.30
		SD	1.64	1.80	1.72	1.33	1.53	1.61	1.55	1.70	1.41	1.67	1.47	1.31	1.60
Aircraft Electrical Systems Specialist	(78)	M	2.55	2.51	2.04	1.48	3.26	3.35	3.29	1.41	1.30	2.23	1.75	1.70	2.60
		SD	1.95	1.93	1.84	1.49	2.12	2.24	2.26	1.84	1.74	2.05	1.81	1.94	2.27
Avionic Instrument Systems Specialist	(23)	M	2.85	2.62	2.17	1.57	3.15	3.14	2.86	1.06	1.10	2.42	1.47	2.19	2.27
		SD	2.17	2.04	2.08	2.01	2.35	2.27	2.35	1.70	1.70	2.35	1.49	2.25	2.36
Ground Radio Equipment Repair	(21)	M	2.18	2.14	1.98	1.81	1.94	1.93	1.81	1.42	1.31	1.49	1.29	1.38	1.37
		SD	1.70	1.56	1.72	1.67	1.50	1.55	1.46	1.29	1.23	1.40	1.20	1.24	1.32
Electrician	(27)	M	2.55	2.44	1.52	1.07	2.67	2.41	2.39	0.77	0.69	0.91	1.20	1.10	1.31
		SD	1.83	1.75	1.51	1.27	1.90	2.18	2.00	1.27	1.12	1.26	1.50	1.47	1.54
Electrical Power Production	(21)	M	2.18	1.95	1.55	0.83	1.97	1.83	1.66	0.85	0.73	0.86	0.68	0.77	0.97
		SD	1.93	1.67	1.64	1.33	1.78	1.66	1.55	1.42	1.36	1.49	1.24	1.40	1.66
Aircraft Fuel Systems Mechanic	(27)	M	2.09	2.10	1.52	1.25	2.30	2.08	2.26	0.80	0.82	1.42	1.19	1.33	1.58
		SD	1.77	1.77	1.65	1.60	1.81	1.85	1.97	1.30	1.30	1.54	1.49	1.69	1.87
Jet Engine Mechanic	(24)	M	2.26	2.22	1.73	1.47	2.26	2.17	2.23	1.19	2.26	2.22	1.73	1.47	1.17
		SD	1.77	1.80	1.75	1.64	1.82	1.82	1.88	1.58	1.77	1.80	1.75	1.64	1.55
Aptitude Area Summary	(218)	M	2.31	2.24	1.75	1.31	2.35	2.30	2.24	1.09	0.98	1.48	1.22	1.32	1.53
		SD	1.85	1.80	1.74	1.59	1.93	1.99	1.97	1.56	1.47	1.77	1.48	1.63	1.86
GRAND MEAN (Tables 4-10 through 4-13)		M	2.21	2.11	1.60	1.29	2.43	2.18	2.08	0.94	0.92	1.86	1.14	1.45	1.12

Note: Frequencies in parenthese indicate sample size (supervisors and subordinates) in an AFSC.

Within the electronics aptitude area, three out of 13 (23%) aptitude area means differed from one another by more than one point on the rating scale; in each of the general and mechanical aptitude areas, four (31%) differed by more than one point on the rating scale; and, in the administrative aptitude area, five out of 13 (38%) differed by more than one point on the rating scale. For each of the four aptitude areas overall, all aptitude area SDs differed from one another by less than one point on the rating scale.

"High" and "Low" Performance Variability Classes

The combined means of judgments of performance quality variability of each of the 13 perceptual/psychomotor abilities by all sampled supervisors and subordinates within an AFSC were compared with the overall AFSC mean. If an individual mean deviated from the AFSC mean by at least one SD unit above the AFSC mean, it was inferred that the sampled airmen judged the performance quality variability as a function of the 13 perceptual/psychomotor abilities to be relatively "high" on the ability. If an individual mean deviated from the AFSC overall mean by at least one SD unit below the AFSC mean, it was inferred that the sampled airmen judged the performance quality variability as a function of the 13 perceptual/psychomotor tasks to be relatively "low" in the performance of assigned tasks within an AFSC. The relatively "high" and relatively "low" judgments of performance quality variability as a function of the 13 perceptual/psychomotor abilities are presented for 18 AFSCs in Table 4-14 by aptitude area. For the remaining AFSCs, the plus or minus one SD criterion was not met by any individual taxonomic class.

With the exception of Radio Operator in Table 4-14, the AFSCs previously reported in Table 4-9 are represented again in Table 4-14. However, Table 4-14 includes 11 fewer AFSCs than does Table 4-9. This suggests (a) some consistency in results and (b) somewhat less discriminatory power for the performance quality variability question. Where an AFSC is common to both tables, there is a "high" correspondence between perceptual/psychomotor abilities previously reported in Table 4-9 and again reported in Table 4-14, i.e., if an ability was indicated in Table 4-9, it is highly probable that it will be indicated again in Table 4-14. This correspondence suggests a perceptiveness of the critical abilities required in the performance of assigned tasks within an AFSC. Whatever is essential for successful execution of a task can be expected to dominate observational awareness/alertness. Individual differences in efficient performance, as a rule, are readily communicated and quickly registered. Thus, if a "high" amount of a perceptual/psychomotor ability is required for the performance of assigned tasks within an AFSC, it would follow that not all personnel so engaged would be equally proficient

Table 4-14

"High" and "Low" Performance Quality Variability as a Function of Perceptual/Psychomotor Abilities in 13 AFSCs by Aptitude Area

AFSC	High	Low
Mechanical		
Weapons		Auditory Discrimination; Auditory Memory
Carpentry and Masonry Specialist	Manual Dexterity	Auditory Memory
Administrative		
Procurement Specialist	Visual Memory; Clerical Perception	Kinesthetic Memory
Chapel Management	Visual Memory	
Legal Services	Finger Dexterity; Visual Memory; Clerical Perception	Auditory Discrimination; Auditory Memory; Depth Perception
Radio Operator	Finger Dexterity; Manual Dexterity; Control Precision; Position Memory	
Personnel	Finger Dexterity; Visual Memory; Visual Speed and Accuracy; Clerical Perception	Auditory Discrimination; Auditory Memory; Depth Perception; Kinesthetic Memory
Airman Administration	Visual Memory; Clerical Perception	Auditory Discrimination; Auditory Memory; Kinesthetic Memory

Table 4-14 (cont.)

General		
Intelligence Operation and Imagery Interpretation	Visual Memory	Auditory Discrimination; Auditory Memory
Weather Forecaster	Visual Memory; Visual Speed and Accuracy; Clerical Perception; Divided Attention	Auditory Discrimination; Auditory Memory; Kinesthetic Memory
Inventory Management, Materiel Facilities and Supply Systems	Visual Memory; Clerical Perception	Auditory Discrimination; Auditory Memory; Depth Perception
Dental and Preventive Dentistry Technician	Finger Dexterity; Manual Dexterity	Auditory Discrimination; Auditory Memory
Graphics	Finger Dexterity; Manual Dexterity; Visual Memory	Auditory Discrimination; Auditory Memory
Electronics		
Missile Facilities	Finger Dexterity; Manual Dexterity; Control Precision; Visual Memory; Visual Speed and Accuracy; Position Memory	
Aircraft Electrical Systems Specialist	Visual Speed and Accuracy	
Avionic Instrument Systems Specialist	Finger Dexterity; Manual Dexterity; Visual Memory; Visual Speed and Accuracy; Position Memory; Clerical Perception	Auditory Discrimination; Auditory Memory
Electrician	Finger Dexterity; Visual Memory	Auditory Discrimination; Auditory Memory
Electrical Power Production	Finger Dexterity	

in the performance of those tasks. Similarly if a "low" amount of a perceptual/psychomotor ability is required for the performance of assigned tasks within an AFSC, it would follow that individual differences could be expected to be muted in the performance of those tasks.

The patterns of perceptual/psychomotor abilities emerging in Table 4-14 complement the patterns of perceptual/psychomotor abilities already reported in Table 4-9. The inferences made concerning the patterns in connection with the judgments of the amount of 13 perceptual/psychomotor abilities can be given an additional weight in personnel classification assignments to an aptitude area. For, as performance quality variability as a function of the 13 perceptual/psychomotor abilities increases, the probability of objective achievement within an AFSC decreases with corresponding increases in cost of training and retraining. The more homogeneous the work group in terms of raw talent and operational efficiency, the more productive is that work group toward realizing group aims. Thus, "high" performance quality variability as a function of the 13 perceptual/psychomotor abilities signals a need for reevaluation of classification assignments. "Low" performance quality variability as a function of 13 perceptual/psychomotor abilities confirms that individual differences in the operational display of an ability is not detrimental to the efforts of the work group toward the achievement of designated goals.

Comparison of the grand means for the previous amount data and for the performance quality variability judgments indicates the same four highest and four lowest abilities to be involved in both cases.

Task Information--Amount

The sampled airmen judged the amount of the 13 perceptual/psychomotor abilities required in the efficient performance of each of 60 tasks, as previously described. The judgments were reduced to a task mean for each task in terms of the 13 abilities. Accordingly, 780 (60 x 13) task means were calculated for each of the 35 AFSCs.

To ascertain whether the 60 tasks in an AFSC differed from one another in terms of the 13 perceptual/psychomotor abilities required in the efficient performance of a task, each task mean was compared with the combined mean for supervisors and subordinates for that ability's amount in an AFSC. If a task mean was one-half SD above the combined mean for supervisors and subordinates for an ability, that task was judged to require a relatively high amount of the ability in the efficient performance of the task. If a task mean was one-half SD below the combined mean for supervisors and subordinates, that task was judged to require a relatively low amount of that ability in the efficient performance of that task. This procedure compares each task to every other task on an individual ability basis. The frequencies of task means deviating one-half SD unit above (high) and below (low) the reported combined means for supervisors and subordinates for each of the 13 perceptual/psychomotor abilities in each AFSC according to the four aptitude areas are reported in Tables 4-15 through 4-18.

It can be noted, in general, that 2,629 out of 27,300 (10%) task means deviated one-half SD unit above the perceptual/psychomotor ability mean over the 35 AFSCs and that 1,772 out of 27,300 (6%) task means deviated one-half unit below the perceptual/psychomotor ability means over the 35 AFSCs. The two tasks in each ability which were highest are identified in Table 4-19.

Aptitude areas differed from one another in terms of the frequency of relatively "high" and "low" tasks identified for each of the 13 abilities. In the administrative aptitude area, only 468 out of 7,020 (7%) task means deviated one-half SD unit above the selected criterion means and 297 out of 7,020 (4%) task means deviated below the selected criterion means. In the mechanical aptitude area, 732 out of 6,240 (12%) task means deviated above the selected criterion means and 508 (8%) task means deviated below the selected criterion means. Similarly, in the electronics aptitude area, 784 out of 7,020 (11%) task means deviated above the selected criterion means and 599 out of 7,020 (9%) task means deviated below the selected criterion means. In the general aptitude area, 644 out of 7,020 (9%) task means deviated above and 368 (5%) task means deviated below the selected criterion means. Sampled airmen in the four aptitude areas, therefore, expressed differential judgments concerning the amount of the 13 perceptual/psychomotor abilities required in the efficient performance of the 60 tasks in an aptitude area. It can be surmised that enlisted personnel are sensitive to the requirements of efficient job performance and that different aptitude areas are distinguished by different patterns of perceptual/psychomotor abilities for the efficient performance of assigned tasks.

Moreover, scrutiny of each AFSC confirms the emergence of differential patterns of "high" and "low" deviating task means with respect to the 13 perceptual/psychomotor abilities. It is clear from Tables 4-15 through 4-18 that different tasks, as would be expected, require different amounts of a perceptual/psychomotor ability.

The relative significance of a perceptual/psychomotor ability in the efficient performance of the tasks of an AFSC can be abstracted from Tables 4-15 through 4-18. Thus, for example, "high" and "low" deviations occur very frequently in connection with finger dexterity, manual dexterity, and control precision but considerably less frequently in connection with rate control, depth perception, divided attention, and kinesthetic memory. Weights, therefore, could be assigned to AFSC tasks

Table 4-15

Frequency of Means of Judgments of Tasks Relative to Amount of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 8 AFSCs and Mechanical Aptitude Area

	FD		MD		CP		RC		VM		VS &A		PM		AD		AM		CP		DP		DA		KM		SUM	
AFSC	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
Mechanical																												
Munitions Maintenance	7	8	21	14	11	6	8	-	7	5	10	8	11	4	8	-	6	-	2	8	6	-	3	1	4	-	104	54
Weapons Mechanic	13	15	6	12	4	15	3	12	1	12	5	12	3	14	3	3	3	1	1	1	6	7	2	1	7	8	57	113
Air Passenger and Air Cargo Specialist	13	3	18	13	20	16	19	12	4	2	8	6	7	2	8	3	6	8	7	12	14	4	2	1	3	-	129	82
Aircraft Loadmaster	8	8	5	6	3	1	3	-	-	5	1	4	7	3	6	-	1	-	8	1	3	-	7	-	1	-	53	28
LGM 25 Missile Mechanic	9	4	9	8	10	9	6	6	2	3	3	12	6	8	6	-	5	-	7	-	1	3	2	1	6	14	72	68
Vehicle Operator/ Dispatcher	3	-	16	8	15	5	15	1	2	3	8	2	7	7	15	2	9	-	4	5	15	3	13	5	11	-	133	41
Fuels Specialist	9	17	14	12	16	16	15	9	1	5	4	6	6	7	11	6	11	-	11	11	10	-	6	4	2	-	116	93
Carpentry and Masonry Specialist	11	5	15	9	6	3	4	1	5	4	3	5	9	1	-	-	1	-	8	1	4	-	3	-	-	-	69	29
SUM	73	60	104	82	85	71	73	41	22	39	42	55	56	46	57	14	42	9	48	39	59	17	38	13	34	22	732	508

Table 4-16

Frequency of Means of Judgments of Tasks Relative to Amount of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and Administrative Aptitude Area

	FD		MD		CP		RC		VM		VS &A		PM		AD		AM		CP		DP		DA		SM		SUM	
AFSC	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
Administrative																												
Procurement Specialist	9	-	3	-	-	-	-	-	5	4	-	1	1	-	-	-	-	-	4	-	-	-	-	-	2	-	24	5
Chapel Management	11	11	2	6	2	-	1	-	4	5	4	1	8	2	3	-	2	-	12	7	4	-	2	-	-	-	55	32
Legal Services	21	21	3	7	3	1	2	-	1	3	-	-	5	-	4	-	2	-	2	7	1	-	1	-	-	-	45	39
Radio Operator	9	10	13	9	12	17	1	1	8	5	8	6	12	8	17	17	11	13	7	5	7	-	7	1	4	-	116	92
Personnel	10	6	3	-	2	-	-	-	2	1	3	-	-	-	3	-	-	-	2	2	-	-	-	-	-	-	25	9
Air Traffic Control Operator Technician	17	7	13	6	7	-	4	1	10	9	10	7	6	11	1	-	5	-	6	1	15	12	15	14	3	-	112	68
Airman Administration	8	5	4	4	5	-	-	-	2	5	6	1	2	-	2	-	2	-	-	5	1	-	4	1	3	-	41	21
Supply Services	-	-	3	2	1	-	2	-	-	-	-	-	-	1	1	-	-	-	1	-	-	-	-	-	-	-	8	3
Airport Air Operations	4	4	7	3	2	-	-	-	-	1	2	4	1	-	5	2	-	2	6	8	1	1	6	3	8	-	42	28
SUM	89	64	51	37	34	18	12	2	32	33	33	20	35	22	36	19	22	15	40	35	29	13	35	19	20	22	468	297

Table 4-17

Frequency of Means of Judgments of Tasks Relative to Amount of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and General Aptitude Area

	FD		MD		CP		RC		VM		VS &A		PM		AD		AM		CP		DP		DA		KM		SUM	
AFSC	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
General																												
Intelligence Operations and Imagery Interpretation	6	12	8	11	2	-	1	-	3	8	7	6	7	8	5	-	3	-	7	7	9	-	1	-	3	-	62	52
Weather Forecaster	3	8	2	4	4	1	5	-	2	4	7	7	-	5	7	-	2	-	-	2	-	1	4	4	-	1	36	37
Information Specialist	13	12	7	10	3	-	1	-	7	3	13	-	24	-	2	-	1	-	13	6	3	-	6	-	8	-	101	31
Inventory Management, Materiel Facilities and Supply Systems	2	3	11	7	8	-	8	-	2	5	5	-	-	2	7	-	6	-	4	-	4	-	-	-	1	-	58	17
Medical Services	8	8	9	7	7	3	-	-	7	4	6	3	7	4	6	-	4	-	8	2	-	-	6	2	4	-	72	33
Dental and Preventive Dentistry Technician	11	8	15	9	8	-	4	-	4	3	7	4	9	3	7	-	8	-	9	1	10	-	7	-	3	-	102	28
Fire Protection	9	12	10	19	8	12	8	2	6	7	3	4	3	10	8	5	6	-	6	-	12	4	8	2	-	-	87	77
Graphics	-	11	11	10	-	-	3	-	8	-	4	4	1	5	1	-	1	-	12	11	7	6	4	-	-	-	52	47
Still Photographic	12	12	12	14	10	7	6	-	2	6	7	7	5	-	4	-	-	-	6	-	6	-	1	-	3	-	74	46
SUM	64	86	85	91	50	23	36	2	41	40	59	35	56	37	47	5	31	-	65	29	51	11	37	8	22	1	644	368

Table 4-18

Frequency of Means of Judgments of Tasks Relative to Amount of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and Electronics Aptitude Area

	FD		MD		CP		RC		VM		VS &A		PM		AD		AM		CP		DP		DA		KM		SUM	
AFSC	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
Electronics																												
Missile Electronic Equipment Specialist	8	7	13	8	13	5	5	-	6	6	6	11	8	5	11	-	12	-	7	6	5	-	6	-	5	-	105	48
Missile Facilities	9	9	14	11	18	13	4	-	7	5	7	6	18	7	11	8	6	1	4	2	-	2	2	5	16	10	116	79
Aircraft Electrical Systems Specialist	12	16	10	15	7	9	3	2	5	9	6	4	4	8	4	-	4	-	6	5	2	11	1	-	7	8	71	87
Avionic Instrument Systems Specialist	6	8	7	3	3	8	3	7	3	4	4	7	4	7	-	-	1	-	1	4	3	4	1	2	5	7	41	61
Ground Radio Equipment Repair	14	17	15	21	14	13	4	4	8	7	12	8	3	9	13	12	14	3	7	4	2	-	2	-	10	11	118	109
Electrician	7	9	4	8	16	1	-	-	1	4	2	4	1	5	3	-	2	-	2	-	-	-	-	-	-	1	38	32
Electrical Power Production	4	10	10	7	8	13	7	-	7	6	11	12	13	12	8	8	8	-	10	-	2	-	4	-	7	-	99	68
Aircraft Fuel Systems Mechanic	10	6	8	5	3	1	3	-	11	6	6	5	4	4	4	1	2	-	12	1	3	-	-	-	8	1	74	30
Jet Engine Mechanic	12	9	15	18	13	17	9	2	9	6	14	-	10	18	9	-	6	-	10	3	5	9	4	-	6	3	122	85
SUM	82	91	96	96	95	80	38	15	57	53	68	57	65	75	63	29	55	4	59	25	22	26	20	7	64	41	784	599
OVERALL SUM (Tables 4-15 through 4-18)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	161	67	130	47	140	64	2629	1772

Table 4-19

Two Tasks Which Were Highest on Each Perceptual/Psychomotor Ability

Ability	Task (Mean Rating*, Specialty)
Finger Dexterity	Draw symbols, emblems or pictures on graphics or masters (6.53*, Graphics)
	Letter graphics products such as charts, posters, or certificates using freehand pen techniques (6.44, Graphics)
Manual Dexterity	Solder, splice or replace wiring or connectors in instrument systems (6.00, Avionics Instrument Systems)
	Assemble or wire radio or auxiliary equipment components for installation (6.10, Ground Radio Equipment Repair)
Control Precision	Operate standard gasoline or electric powered forklifts (6.23, Munitions Maintenance)
	Operate munitions transport trucks or truck-tractors (6.19, Munitions Maintenance)
Rate Control	Operate standard gasoline or electric powered forklifts (6.08, Munitions Maintenance)
	Operate munitions transport trucks or truck-tractors (6.00, Munitions Maintenance)
Visual Memory	Calibrate or adjust heads-up display (6.33 Avionics Instrument Systems)
	Compare climatological factors with weather systems (5.89, Weather Forecaster)
Visual Speed & Accuracy	Remove and inspect engine bearings (6.13, Jet Engine Mechanic)
	Locate meteorological features on charts (5.90, Weather Forecaster)
Position Memory	Perform preflight or postflight inspections on static discharges (6.00, Radio Operator)
	Prepare aircraft for engine removal or installation (5.96, Jet Engine Mechanic)
Auditory Discrimination	Operate rotating antenna equipment for maximum signal strength (6.13, Radio Operator)
	Make receiver changes or adjustments to reduce interference (6.13, Radio Operator)

Table 4-19 (cont.)

Auditory Memory	Report interference caused by jamming (5.87, Radio Operator) Determine type of interference (5.53, Radio Operator)
Clerical Perception	Perform graphical or statistical analysis of technical studies (6.13, Weather Forecaster) Perform pure system analysis (5.89, Weather Forecaster)
Depth Perception	Establish landing sequences (5.70, Air Traffic Control Operator) Hold arriving VFR aircraft at visual fixes (5.19, Air Traffic Control Operator)
Divided Attention	Establish landing sequences (6.26, Air Traffic Control Operator) Test personnel under operational conditions (6.11, Air Traffic Control Operator)
Kinesthetic Memory	Load film onto reels (4.92, Still Photographic) Remove and install components within fuel cells (4.70, Aircraft Fuel Systems Mechanic)

in terms of the amount of the ability judged to be required for efficient performance of those tasks. That is to say, perceptual/psychomotor abilities vary in their contributions to job efficiency; attention needs to be focused on some abilities and withdrawn from others.

Task Information--Performance Quality Variability

To ascertain whether the 60 tasks in an AFSC differed from one another in terms of performance quality variability as a function of the 13 perceptual/psychomotor abilities, each task mean was compared with the combined mean for supervisors and subordinates. Accordingly, 780 comparisons were made in each AFSC separately. If a task mean was one-half SD unit above the ability, that task was judged to display a relatively "high" performance quality variability as a function of the 13 perceptual/psychomotor abilities. If a task mean was one-half SD unit below the ability mean, that task was judged to display a relatively low performance quality variability. The frequencies of task means deviating one-half SD unit above (high) and below (low) the combined means are reported in Tables 4-20 through 4-23.

Of the total, 1,261 (4.6%) task means deviated one-half SD unit above the ability mean combined for supervisors and subordinates with respect to performance quality variability and 635 (2%) task means deviated one-half SD unit below the ability mean with respect to performance quality variability. On the general level, these data suggest that performance quality variability as a function of the 13 perceptual/psychomotor abilities was not perceived as being a significant variable in assessing job efficiency. In general, the findings suggest that the sample airmen believed efficient performance of assigned tasks in their respective AFSCs to be fairly uniform as a function of the abilities considered.

More specifically, the four aptitude areas did not differ from one another appreciably in terms of the frequency of relatively "high" and "low" tasks identified for each of the 13 abilities. In each of the four aptitude areas, approximately 1 percent of the task means deviated one-half SD unit above the selected criterion mean. In the mechanical and the electronics aptitude areas, approximately 1 percent of the task means deviated one-half unit below the selected criterion mean, and less than 1 percent so deviated in both the administrative and the general aptitude areas.

The relative significance of the perceptual/psychomotor analysis relative to performance quality variability can be abstracted from Tables 4-20 through 4-23. Frequencies of such deviations also varied only slightly between and within AFSCs.

Table 4-20

Means of Judgments of Tasks Relative to Performance Quality Variability as a Function of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 8 AFSCs and Mechanical Aptitude Area

	FD		MD		CP		RC		VM		VS &A		PM		AD		AM		CP		DP		DA		KM		SUM	
AFSC	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
Mechanical																												
Munitions Maintenance	5	1	10	1	4	-	3	1	-	1	4	1	-	1	-	-	2	1	-	3	7	-	-	1	2	-	37	11
Weapons Mechanic	4	7	4	7	2	8	2	6	1	10	1	6	-	9	1	-	1	1	5	1	-	-	-	4	4	7	25	66
Air Passenger and Air Cargo Specialist	2	-	5	2	9	3	3	4	2	3	6	2	3	-	7	2	3	1	5	2	3	-	1	-	-	-	49	19
Aircraft Loadmaster	-	2	-	4	-	-	-	-	-	3	-	-	2	1	-	-	-	-	4	-	-	-	2	1	-	-	8	11
LGM 25 Missile Mechanic	1	1	6	10	7	7	2	4	2	2	2	1	4	1	1	-	1	-	3	-	2	-	-	-	2	6	33	32
Vehicle Operator/ Dispatcher	2	1	6	2	12	3	13	1	-	1	4	2	2	1	11	-	10	-	2	1	14	-	2	-	3	-	81	12
Fuels Specialist	3	2	6	8	7	4	6	7	2	1	3	3	2	4	10	2	6	2	10	6	4	-	1	-	1	-	61	39
Carpentry and Masonry Specialist	-	2	7	6	-	-	-	-	2	2	2	1	1	1	-	-	-	-	-	-	-	-	-	-	1	-	13	12
SUM	17	16	44	40	41	25	29	23	9	23	22	16	14	18	30	4	23	5	29	13	30	-	6	6	13	13	307	202

Table 4-21

Means of Judgments of Tasks Relative to Performance Quality Variability as a Function of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and Administrative Aptitude Area

	FD		MD		CP		RC		VM		VS &A		PM		AD		AM		CP		DP		DA		KM		SUM	
AFSC	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
Administrative																												
Procurement Specialist	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Chapel Management	8	3	1	-	1	-	-	-	2	1	3	-	3	2	1	-	-	-	8	4	2	-	-	-	-	-	29	10
Legal Services	9	8	4	-	3	-	1	-	-	4	-	-	1	-	5	-	5	-	3	3	-	-	2	-	-	-	33	15
Radio Operator	7	4	8	5	8	3	2	-	2	5	6	1	5	2	7	5	7	2	5	-	2	-	5	2	1	-	49	29
Personnel	4	-	-	-	1	-	-	-	2	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	9	-
Air Traffice Control Operator Technician	5	-	9	-	7	-	2	-	10	7	4	5	4	5	4	4	2	-	4	-	9	5	8	8	2	-	70	34
Airman Administration	7	1	2	-	3	-	2	-	4	4	-	3	2	-	1	-	1	-	2	1	1	-	1	-	3	-	29	9
Supply Services	-	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	3
Airport Air Operations	2	2	1	1	1	-	2	-	-	-	3	-	1	-	1	-	-	-	-	-	3	3	2	2	-	-	16	8
SUM	42	19	26	8	24	3	9	-	20	22	16	9	10	9	20	9	15	2	23	8	17	8	18	12	6	-	246	109

Table 4-22

Means of Judgments of Tasks Relative to Performance Quality Variability as a Function of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and General Aptitude Area

	FD		MD		CP		RC		VM		VS &A		PM		AD		AM		CP		DP		DA		EH		SUM	
AFSC	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
General																												
Intelligence Operations and Imagery Interpretation	11	2	7	4	3	-	1	-	8	4	5	3	7	3	5	-	6	-	4	5	1	-	1	-	4	-	63	21
Weather Forecaster	-	1	-	-	-	-	4	-	1	2	1	3	-	1	2	-	6	-	3	1	-	1	2	-	-	-	19	9
Information Specialist	8	5	3	-	4	-	3	-	10	10	4	-	1	-	-	-	16	-	9	4	3	-	1	-	2	-	64	19
Inventory Management, Materiel Facilities and Supply Systems	2	2	4	1	5	-	5	-	4	-	1	-	2	-	2	-	2	24	2	-	3	-	-	-	1	-	33	27
Medical Services	6	2	3	3	3	-	2	-	4	4	2	1	3	-	5	-	5	-	4	2	1	-	6	1	-	-	44	13
Dental and Preventive Dentistry Technician	8	3	5	-	3	-	2	-	1	1	3	-	3	-	6	-	5	-	12	-	4	-	2	-	1	-	55	4
Fire Protection	5	1	6	6	7	2	6	-	2	2	1	-	2	1	3	-	-	-	3	-	5	-	3	-	1	-	44	17
Graphics	8	5	8	3	4	-	-	-	2	5	2	-	2	1	2	-	1	-	4	6	7	-	2	-	-	-	42	20
Still Photographic	7	2	10	6	5	1	4	-	-	2	1	-	3	-	1	-	2	-	1	-	4	-	-	-	4	-	42	11
SUM	55	23	46	23	34	3	27	-	32	30	20	7	23	6	26	-	43	24	42	18	28	1	17	1	13	-	406	136

Table 4-23

Means of Judgments of Tasks Relative to Performance Quality Variability as a Function of 13 Perceptual/Psychomotor Abilities One-Half SD Unit Above and Below Relevant Means in 9 AFSCs and Electronics Aptitude Area

AFSC	FD		MD		CP		RC		VM		VS &A		PM		AD		AM		CP		DP		DA		KM		SUM	
	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L
Electronics																												
Missile Electronic Equipment Specialist	3	-	3	-	2	-	2	-	3	-	1	-	1	-	4	-	3	-	5	-	2	-	2	-	-	-	31	-
Missile Facilities	3	3	3	10	17	10	1	-	3	2	4	-	2	6	2	4	1	-	1	-	1	-	1	1	2	3	41	39
Aircraft Electrical Systems Specialist	10	6	9	7	1	4	2	1	-	1	1	4	-	5	-	-	-	-	1	-	-	-	-	-	7	4	31	32
Avionic Instrument Systems Specialist	2	7	3	4	6	6	3	2	4	4	6	5	2	7	-	-	1	-	2	10	1	1	1	1	4	6	35	53
Ground Radio Equipment Repair	7	3	7	2	1	-	2	-	3	-	2	-	1	-	4	-	2	-	1	-	1	-	1	-	1	-	33	5
Electrician	-	4	-	3	-	-	1	-	-	4	-	3	-	3	2	-	1	-	2	-	-	-	-	-	-	-	6	17
Electrical Power Production	3	4	4	1	5	5	1	-	1	1	-	4	2	1	10	-	3	-	7	-	1	-	4	-	1	-	42	16
Aircraft Fuel Systems Mechanic	7	-	5	-	4	-	-	-	1	-	1	-	-	-	-	-	-	-	3	-	-	-	-	-	7	-	28	-
Jet Engine Mechanic	4	2	7	4	7	3	5	2	5	2	5	3	4	7	6	-	3	-	1	-	3	3	3	-	2	-	55	26
SUM	39	29	41	31	43	28	17	5	20	14	20	19	12	29	28	4	14	-	23	10	9	4	12	2	24	13	302	188
OVERALL SUM (Tables 4-20 through 4-23)	153	87	157	102	142	59	82	28	81	89	78	51	59	62	104	17	93	31	117	49	84	13	53	21	56	26	1261	635

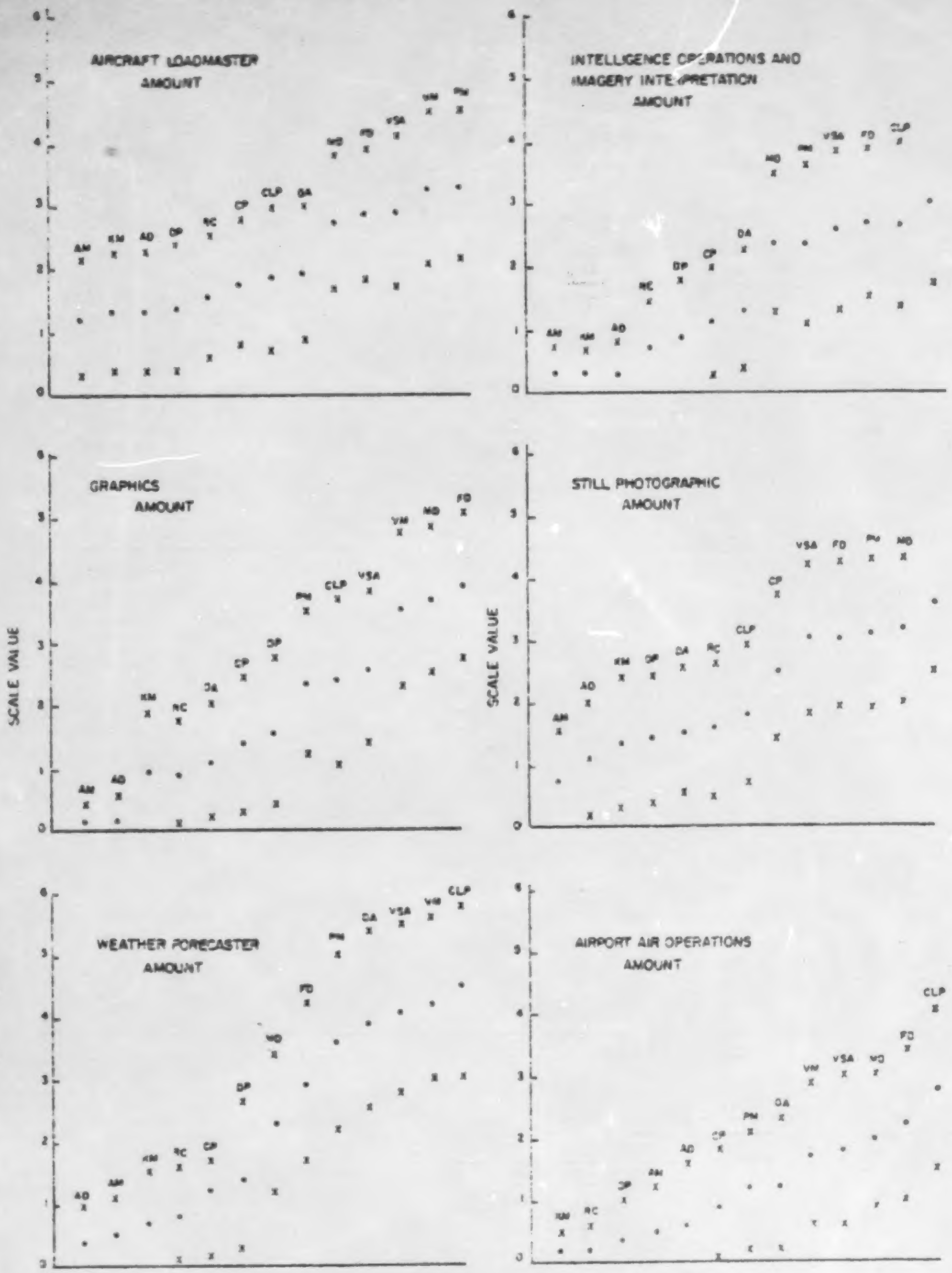
Agreement Between Amount and Performance

As noted earlier, the amount of 13 perceptual/psychomotor abilities in the efficient performance of 60 tasks was judged by supervisors and subordinates. Similarly, supervisors and subordinates judged performance quality variability as a function of the 13 abilities. The two series of perceptual/psychomotor ability means allow for a direct comparison. Accordingly, the two sets of means were separately ranked from low to high by AFSC. These rankings were separately graphed in Figures 4-1 and 4-2 along with the boundaries of one-half SD unit above and below the mean.

The lowest and the highest five ranked ability amount means were compared with the lowest and the highest five ranked performance quality variability means, respectively. It was merely sufficient that, within an AFSC, the mean of a perceptual/psychomotor ability appeared in the appropriate set without regard to hierarchical position within the set. The frequency of matches within the "low" and "high" sets was reduced to a percentage. The percentage was designated as a percentage agreement index. The percentage agreement indices are reported in Table 4-24 according to the four aptitude areas.

It can be immediately noted that 30 out of 35 (86%) of the percentage agreement indices are 90 and 100. The lowest index was obtained for Radio Operator. These data suggest that correspondence exists between the amount of a skill required in efficient performance of a task and the perceived performance quality variability associated with such performance. If it can be assumed that increases in the amount of an ability required for efficient performance can be construed to mean increased criticality for task performance, then it follows that sensitivity to individual difference in efficient performance could be expected to covary with that critical level. The higher the percentage agreement index, the more closely related would be the amount of skill and performance quality variability, i.e., one could not prudently be dissociated from the other.

Moreover, the slopes of the comparable sets of curves parallel each other closely. The frequencies of both sets of ranked means are reported in Table 4-25. Thus, rate control, auditory discrimination, auditory memory, and kinesthetic memory characteristically were among the lowest five ranked means in the two series of judgments. Finger dexterity, manual dexterity, visual memory, visual speed and accuracy, and position memory characteristically were among the highest five ranked means in the two series of judgments. Accordingly, the relative importance of these skills is further established in the efficient



FD = Finger Dexterity
AD = Auditory Discrimination
CP = Control Precision
RC = Rate Control
VM = Visual Memory
VSA = Visual Speed and Accuracy
PM = Position Memory
MD = Manual Dexterity
AM = Auditory Memory
DP = Depth Perception
DA = Divided Attention
KM = Kinesthetic Memory
CLP = Clerical Perception

Figure 4-1. Mean and ± .5 standard deviation for each ability for judgment of amount.

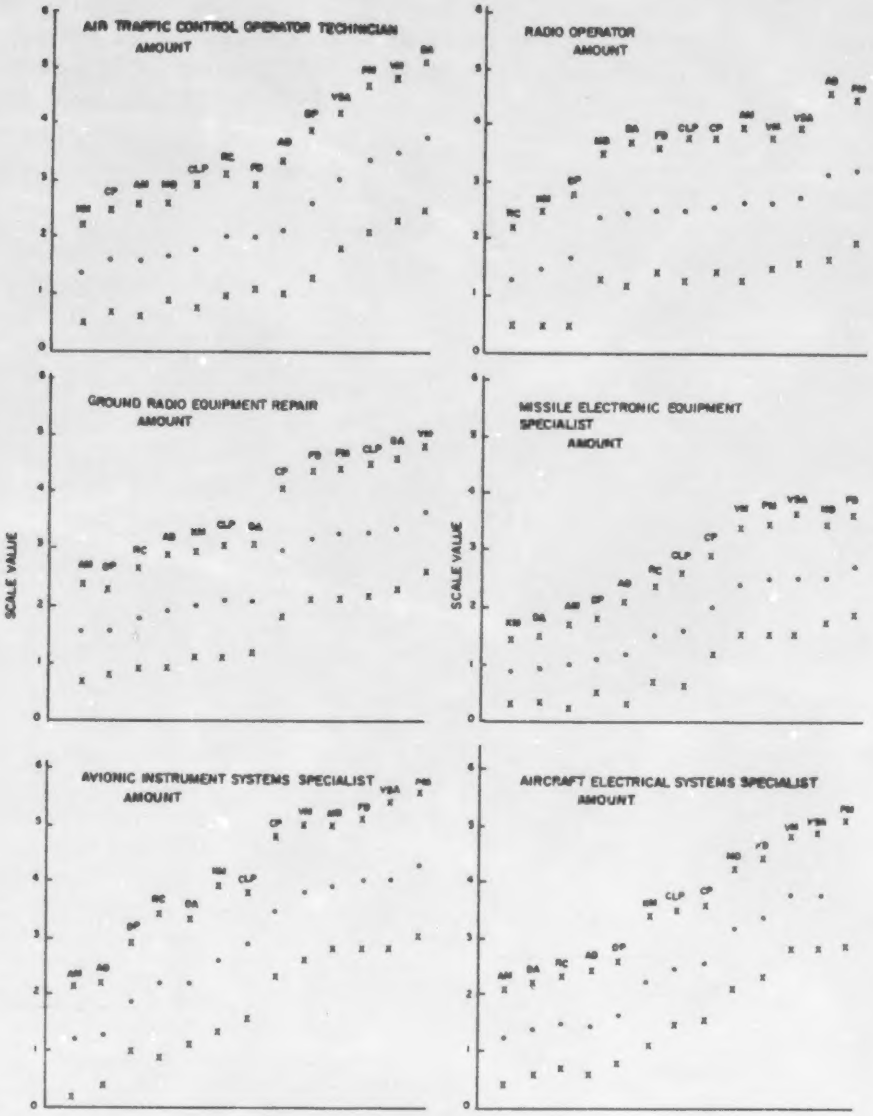


Figure 4-1. Continued.

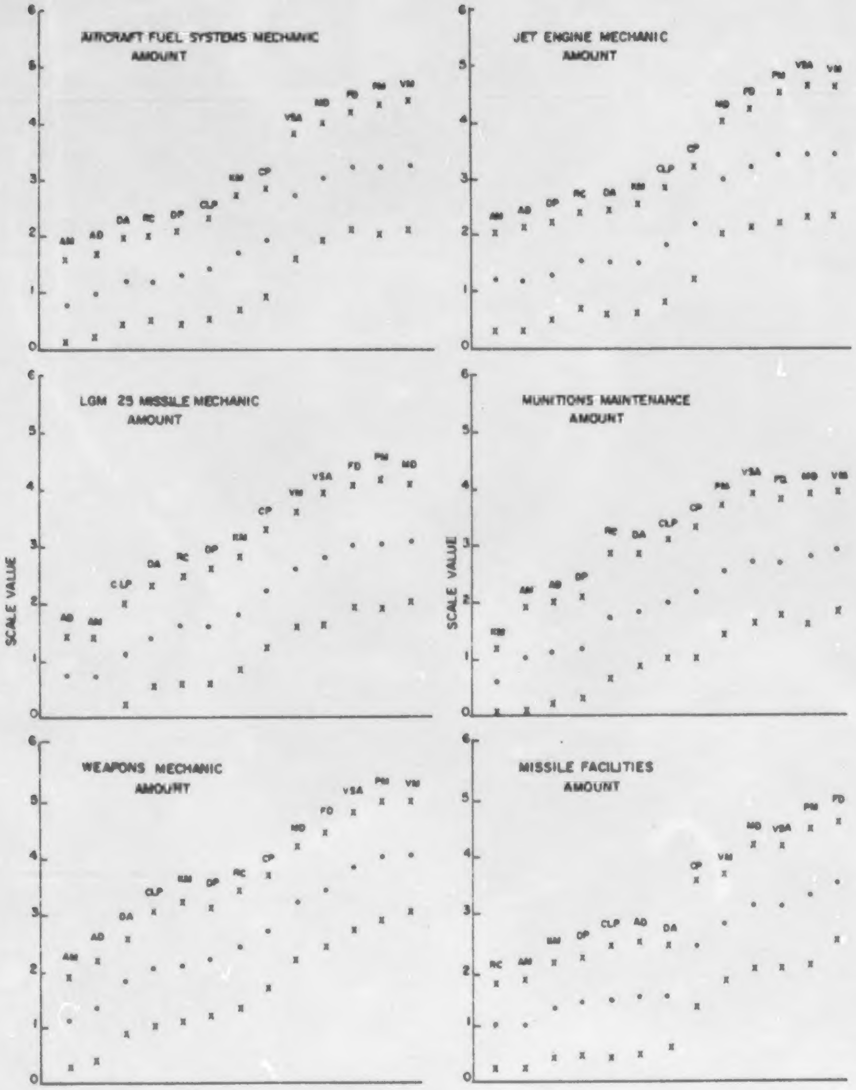


Figure 4-1. Continued

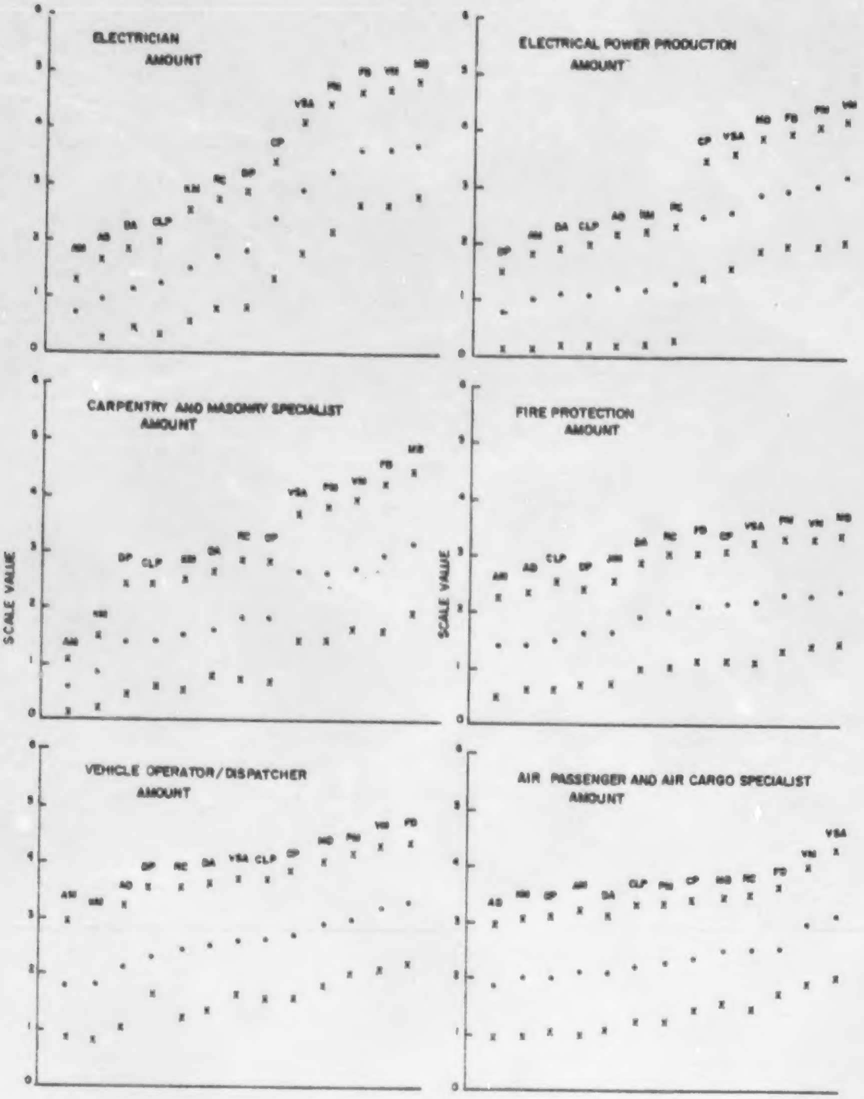


Figure 4-1. Continued

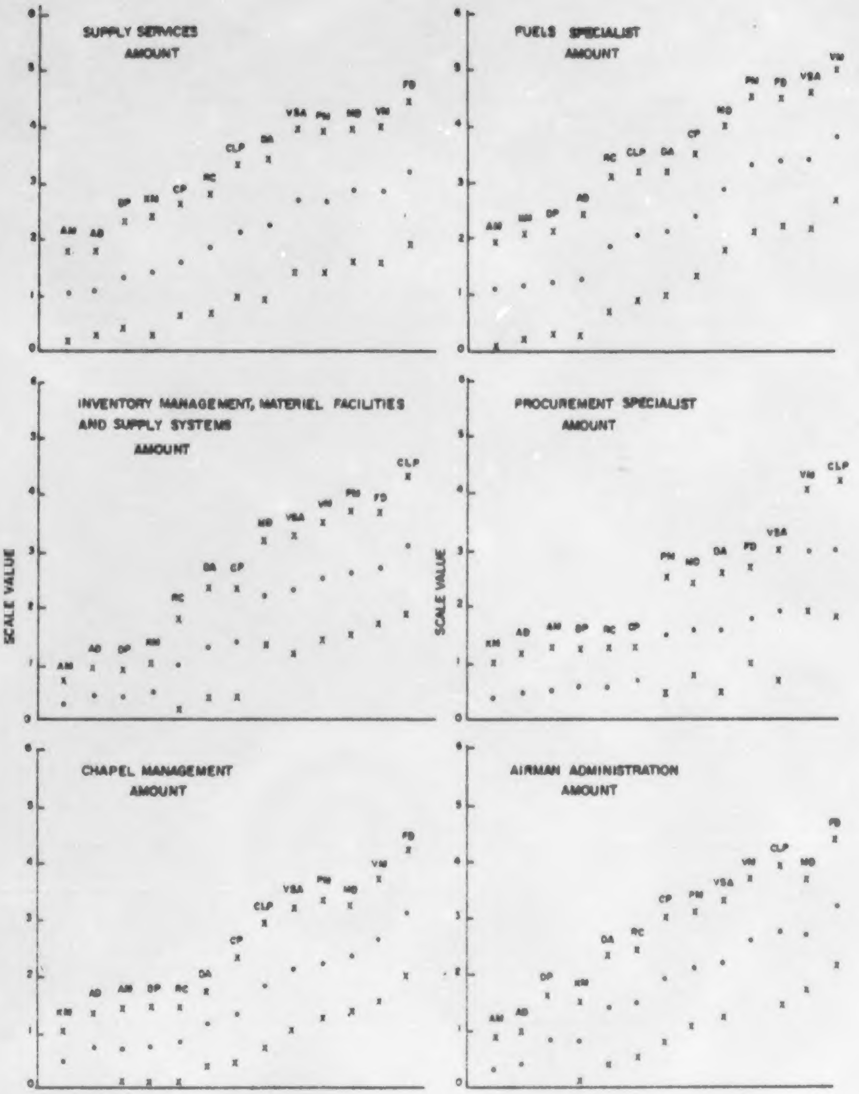


Figure 4-1. Continued.

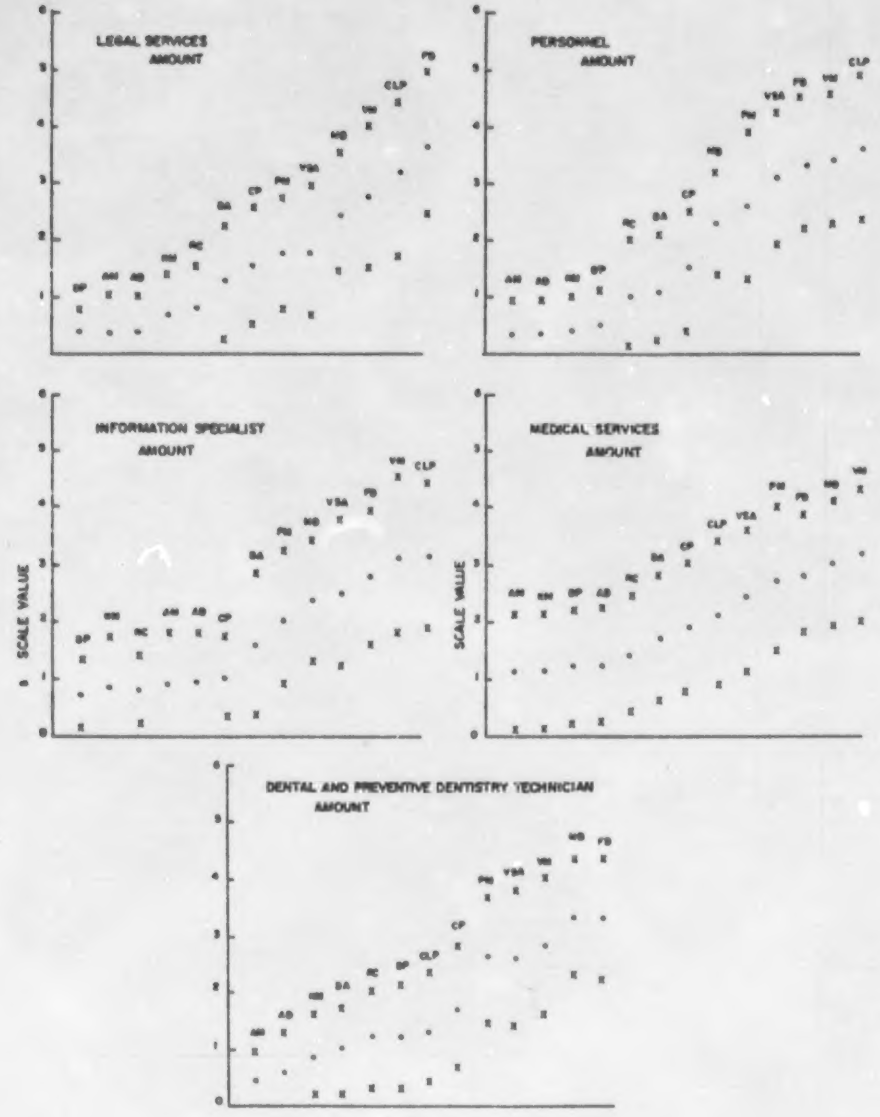
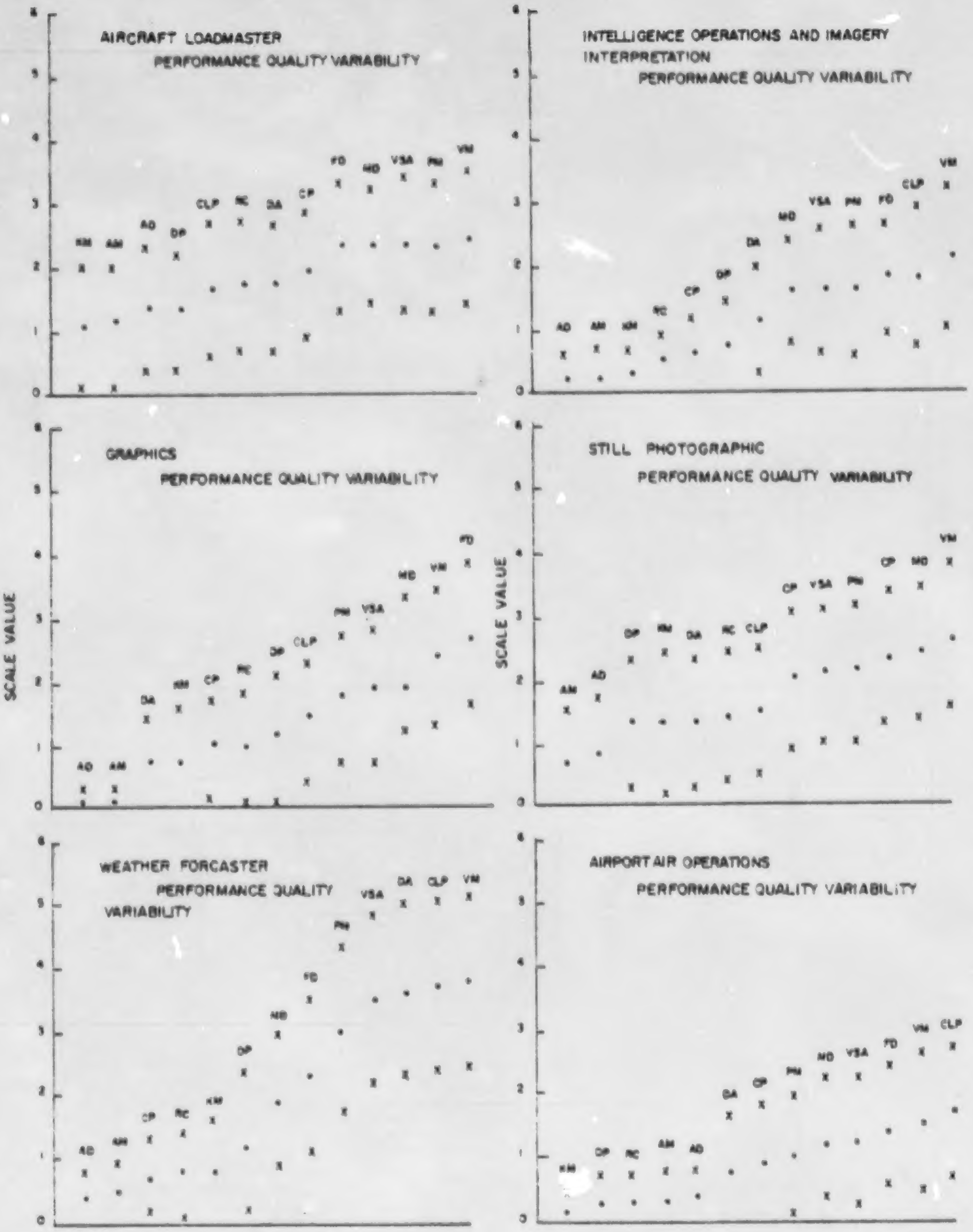


Figure 4-1. Continued.



FD = Finger Dexterity
AD = Auditory Discrimination
CP = Control Precision
RC = Rate Control
VM = Visual Memory
VSA = Visual Speed and Accuracy
PM = Position Memory
MD = Manual Dexterity
AM = Auditory Memory
DP = Depth Perception
DA = Divided Attention
KM = Kinesthetic Memory
CLP = Clerical Perception

Figure 4-2. Mean and ± .5 standard deviation for each ability for judgments of quality and variability.

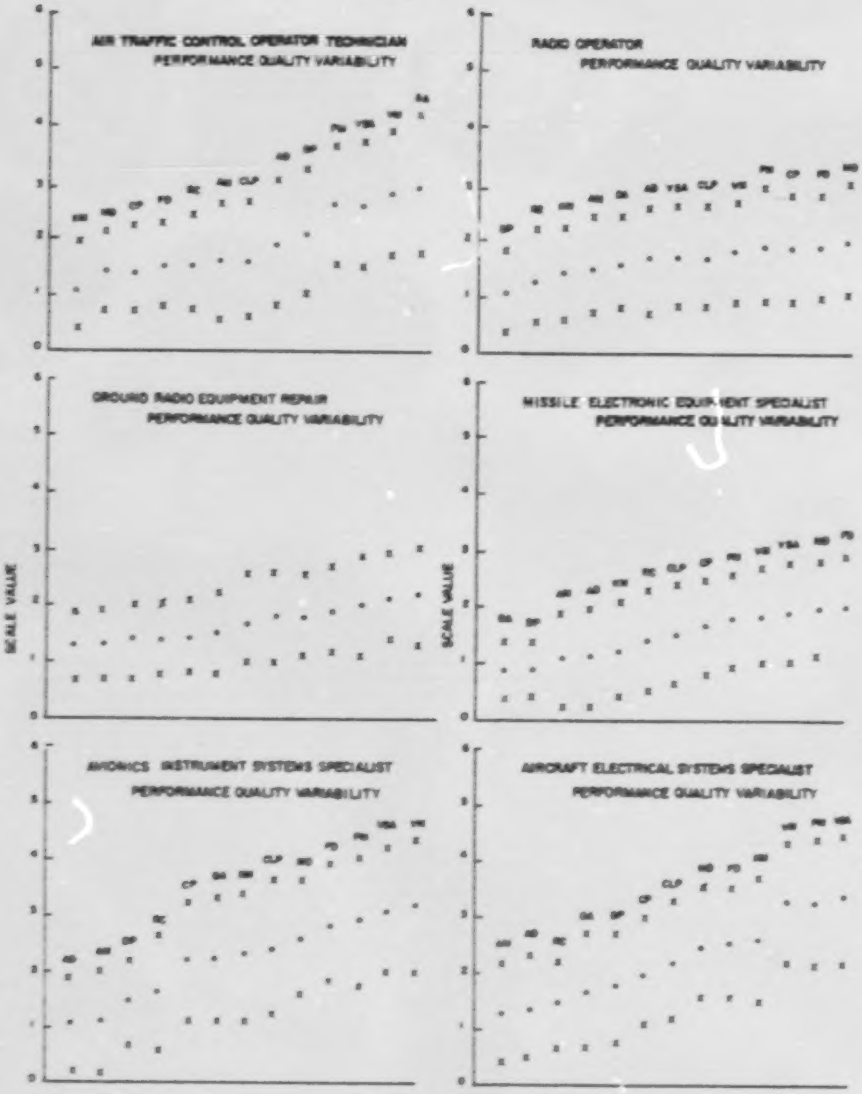


Figure 4-2. Continued.

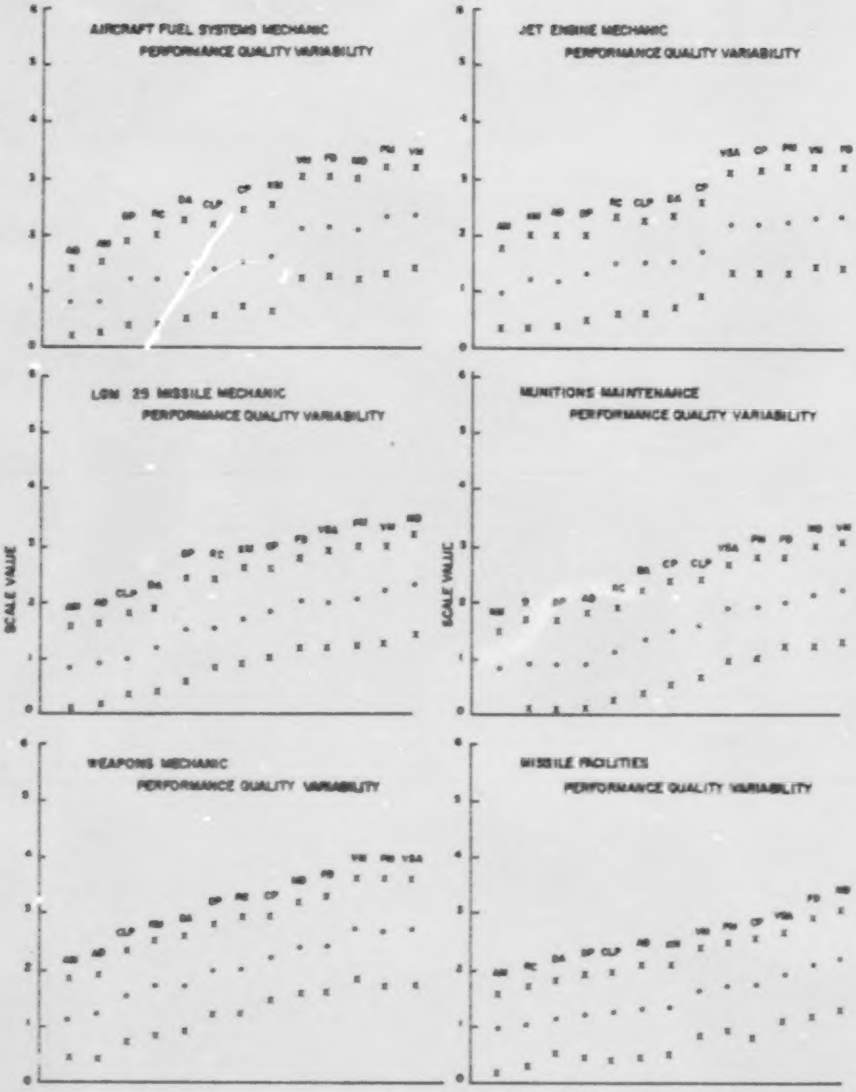


Figure 4-2. Continued.

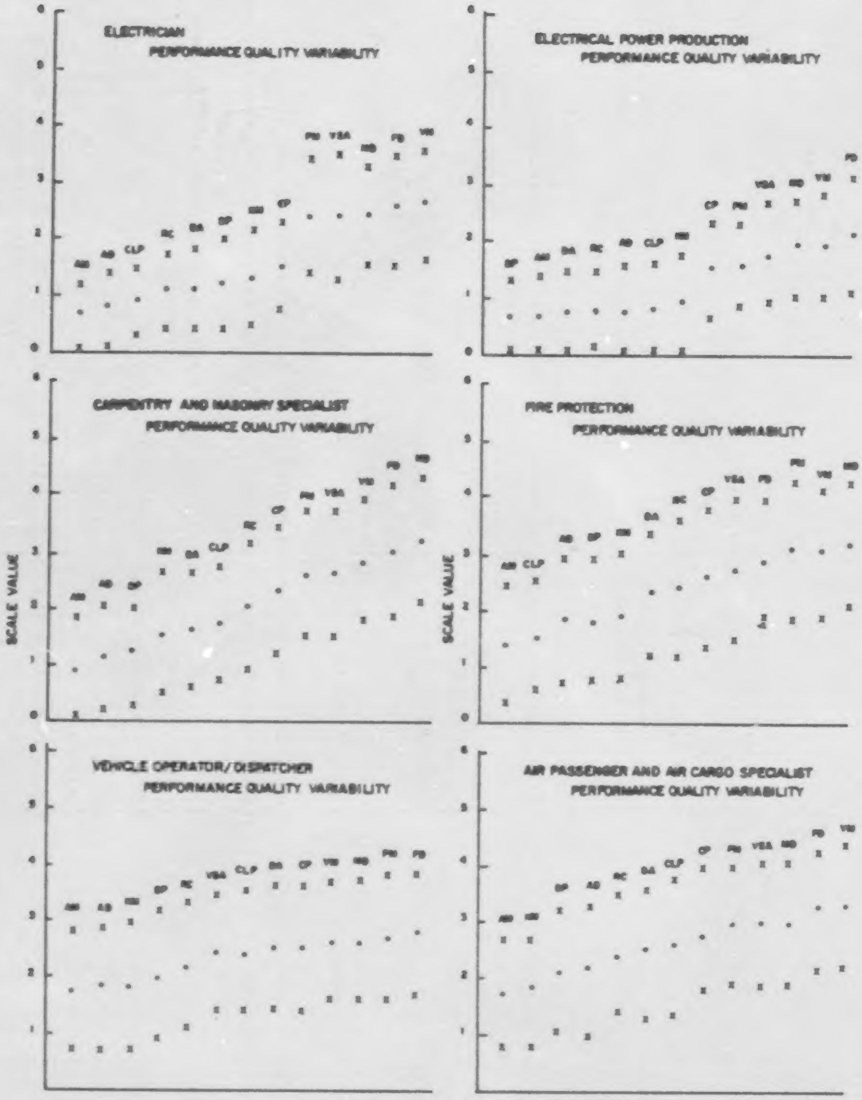


Figure 4-2. Continued.

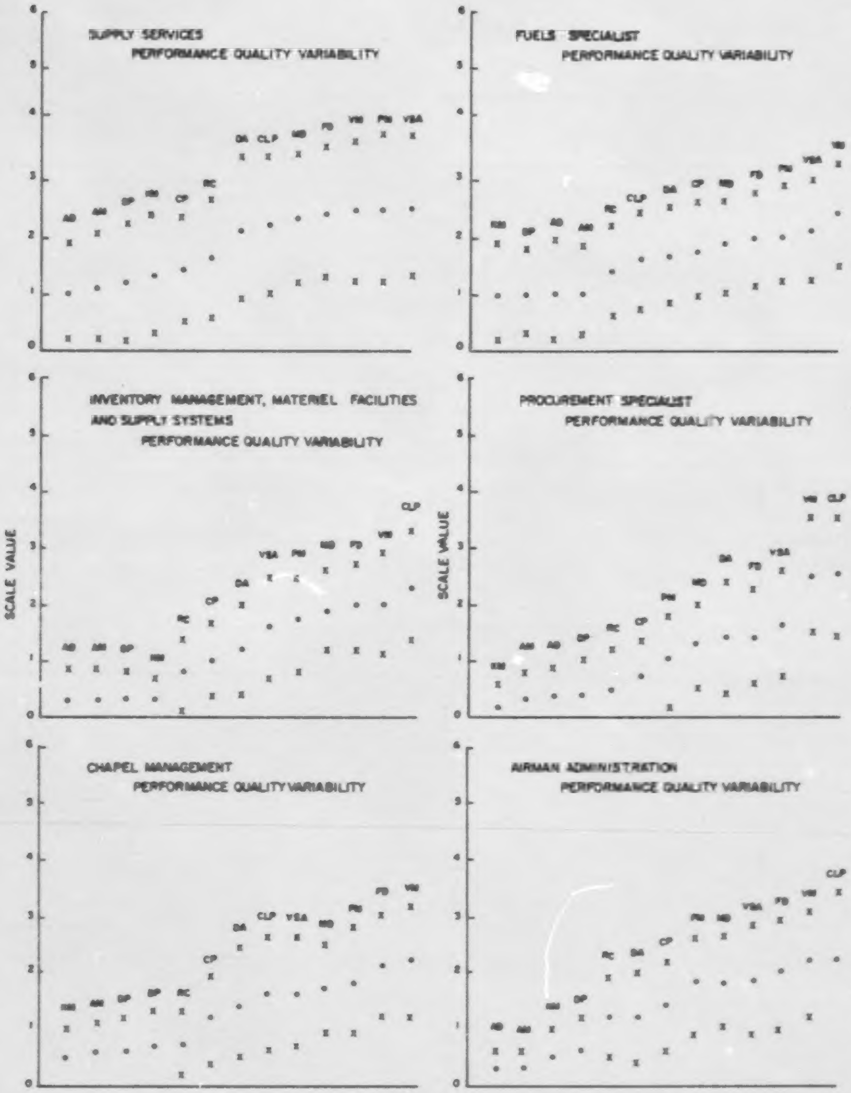


Figure 4-2. Continued

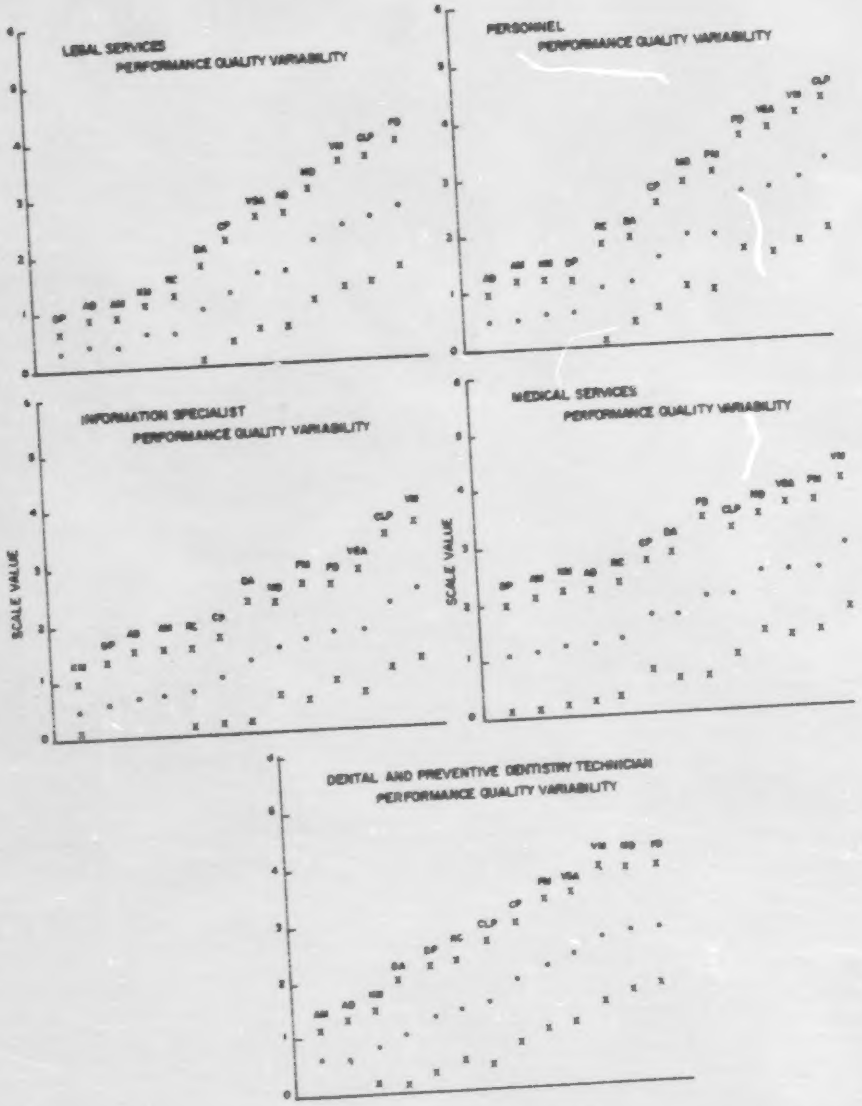


Figure 4-2 Continued

Table 4-24

Agreement Indices Between Means of Judgments of Amount and of Performance Quality Variability

AFSC	% Agreement
Mechanical	
Munitions Maintenance	100
Weapons Mechanic	100
Air Passenger and Air Cargo Specialist	80
Aircraft Loadmaster	90
LGM 25 Missile Mechanic	90
Vehicle Operator/ Dispatcher	100
Fuels Specialist	100
Carpentry and Masonry Specialist	90
Administrative	
Procurement Specialist	100
Chapel Management	100
Legal Services	90
Radio Operator	60
Personnel	100
Air Traffic Control Operator Technician	90
Airman Administration	90
Supply Services	100
Airport Air Operations	100
General	
Intelligence Operations and Imagery Interpretation	90
Weather Forecaster	100
Information Specialist	90
Inventory Management, Materiel Facilities and Supply Systems	90
Medical Services	90
Dental and Preventive Denistry Technician	90
Fire Protection	90
Graphics	80
Still Photographic	100
Electronics	
Missile Electronic Equipment Specialist	100
Missile Facilities	80
Aircraft Electrical Systems Specialist	90
Avionic Instrument Systems Specialist	90
Ground Radio Equipment Repair	80
Electrician	90
Electrical Power Production	90
Aircraft Fuel Systems Mechanic	100
Jet Engine Mechanic	90

Table 4-25

Frequency of Occurrence of Ability Means for Amount and of Performance Quality Variability in High and Low Categories

	Amount		Quality	
Ability	Low	High	Low	High
Finger Dexterity	-	31	1	31
Manual Dexterity	2	29	1	28
Control Precision	3	2	7	4
Rate Control	23	1	23	-
Visual Memory	-	35	-	33
Visual Speed and Accuracy	-	32	-	30
Precision Memory	-	28	-	32
Auditory Discrimination	31	1	32	-
Auditory Memory	32	-	34	-
Clerical Perception	7	9	6	9
Depth Perception	26	1	29	1
Divided Attention	13	4	14	3
Kinesthetic Memory	27	-	28	1

performance of assigned AFSC tasks. It could be that these skills are more or less necessary for effective duty performance and should be seriously attended to in career assignments.

Pearson coefficients of correlation were also computed between ability means and the performance quality variability means across the 35 AFSCs. The correlation coefficient for each AFSC is reported in Table 4-26 according to the four aptitude areas.

It can be immediately noted that 32 (91%) of the obtained coefficients exceed .900. The lowest correlation was obtained for Radio Operator. The correlation coefficients for Air Passenger and Air Cargo Specialist and for Ground Radio Equipment Repairman were .794 and .820, respectively. The median correlation coefficient was .971. A high correspondence was again demonstrated, therefore, between the ability means and performance quality variability means. For all practical purposes, the two series of judgments were communicating essentially the same information concerning the role of the 13 perceptual/psychomotor abilities in the efficient performance of the tasks of an AFSC. Differential perceptions concerning the amount of a skill and performance quality covaried, as a rule. Common factors seemed to have been operating in influencing the sampled airmen in rendering the two series of judgments.

Supervisor-Subordinate Agreement

Product moment correlation coefficients were calculated between the mean data for both the amount and performance quality variability ratings made by the supervisors and the subordinates within each career field. The resulting correlation coefficients are presented in Table 4-27.

With the exception of two AFSCs (Air Passenger and Cargo Specialist and Radio Operator), the correlation between supervisors and subordinates was very high. An examination of the individual judgments for the two career fields with low supervisor-subordinate correlations revealed that two supervisors in each group were divergent from the others. The effects of the two divergent sets of judgments were powerful enough, with the relative sample sizes, to depress the resultant correlation coefficients.

The correlations for the career fields, in Table 4-27, were converted to z' coefficients and averaged. The average correlations, across the 35 career fields, were .94 for amount judgments and .90 for performance quality judgments. It is apparent from correlations as high as those obtained that supervisors and subordinates, within a given

Table 4-26

Correlation (r) Between Amount of 13 Perceptual/Psychomotor Skills and Judgments of Performance Quality Variability

AFSC	r	AFSC	r
Mechanical			
Munitions Maintenance	0.978	Weather Forecaster	0.992
Weapons Mechanic	0.974	Information Specialist	0.972
Air Passenger and Air Cargo Specialist	0.794	Inventory Management, Materiel Facilities and Supply Systems	0.985
Aircraft Loadmaster	0.946	Medical Services	0.954
LGM 25 Missile Mechanic	0.968	Dental and Preventive Dentistry Technician	0.980
Vehicle Operator/ Dispatcher	0.949	Fire Protection	0.974
Fuels Specialist	0.983	Graphics	0.987
Carpentry and Masonry Specialist	0.967	Still Photographic	0.986
Administrative		Electronics	
Procurement Specialist	0.993	Missile Electronic Equipment Specialist	0.959
Chapel Management	0.953	Missile Facilities	0.931
Legal Services	0.994	Aircraft Electrical Systems Specialist	0.953
Radio Operator	0.680	Avionic Instrument Systems Specialist	0.930
Personnel	0.993	Ground Radio Equipment Repair	0.820
Air Traffic Control Operator Technician	0.976	Electrician	0.971
Airman Administration	0.960	Electrical Power Production	0.970
Supply Services	0.963	Aircraft Fuel Systems Mechanic	0.975
Airport Air Operations	0.959	Jet Engine Mechanic	0.975
General			
Intelligence Operations and Imagery Interpretation	0.989		

Table 4-27

Correlation Between Supervisor and Subordinate Ratings for Amount (A) and Performance Quality Variability (PQV) Judgments

	Correlation	
AFSC	A	PQV
Mechanical		
Munitions Maintenance	.94	.90
Weapons Mechanic	.98	.88
Air Passenger and Air Cargo Specialist	.29	.76
Aircraft Loadmaster	.93	.89
LGM 25 Missile Mechanic	.98	.91
Vehicle Operator/Dispatcher	.95	.76
Fuels Specialist	.95	.87
Carpentry and Masonry Specialist	.85	.85
Administrative		
Procurement Specialist	.97	.98
Chapel Management	.98	.96
Legal Services	.94	.92
Radio Operator	.63	.50
Personnel	.95	.94
Air Traffic Control Operator Technician	.89	.92
Airman Administration	.97	.92
Supply Services	.82	.77
Airport Air Operations	.84	.70
General		
Intelligence Operations and Imagery Interpretation	.95	.97
Weather Forecaster	.97	.95
Information Specialist	.90	.77
Inventory Management Materiel Facilities and Supply Systems	.94	.97
Medical Services	.90	.82
Dental and Preventive Dentistry Technician	.89	.86
Fire Protection	.96	.82
Graphics	.96	.91
Still Photographic	.96	.98
Electronics		
Missile Electronic Equipment Specialist	.94	.85
Missile Facilities	.97	.88
Aircraft Electrical Systems Specialist	.91	.83
Avionic Instrument Systems Specialist	.99	.95
Ground Radio Equipment Repair	.83	.86
Electrician	.94	.97
Electrical Power Production	.96	.94
Aircraft Fuel Systems Mechanic	.93	.96
Jet Engine Mechanic	.94	.76
Average	.94	.90

career field, may be regarded as representative of a single Air Force population of job incumbents for the purpose of job analytic judgments such as those made in the present survey.

Profile Similarity

An index of profile similarity was computed to compare the profiles of the 35 AFSCs. The amount and the performance quality variability profiles were considered separately. The index of profile similarity employed was the D statistic (Osgood and Suci, 1952). The equation for computing the D statistic is:

$$D = \sqrt{\Sigma d^2}$$

where:

d = difference between the score on an ability for one specialty and the score on the same ability for another specialty.

The equation considers both the shape and the elevation of the profiles compared and is superior to the product moment correlation in this regard because the product moment correlation considers only shape. The D statistic was computed among all AFSCs (35 x 34/2) for amount and for performance quality variability. The profiles were categorized as essentially similar or essentially dissimilar. The essentially similar criterion was a D score of 2.52 (10%) of the maximum range of the D statistic or less. The percentage of the specialties which met the "essentially similar with the other AFSCs criterion" was computed. The results are shown in Table 4-28. For amount, the Weather Forecaster AFSC never met the criterion and the Medical Services Specialist AFSC met the criterion for 76 percent of the comparisons. Accordingly, the Weather Forecaster AFSC is more independent than the Medical Services Specialist AFSC. The median percentage in Table 4-28 is 50 for amount and 65 for performance quality variability. There is some evidence for partial, but not high, independency among the AFSCs.

Intercorrelations Among Abilities and Factor Analysis--Amount

The mean ratings of the amount of each ability (across 60 tasks) for each AFSC were intercorrelated to yield a 13 by 13 matrix. The resultant matrix of intercorrelations is shown in Table 4-29. A summary of the product moment correlation coefficients follows:

Table 4-28

Percentage of D Scores in Each AFSC Within 10 Percent of the D Range (2.52) or Less

Specialty	Amount %	PQV % *
Aircraft Loadmaster	68	82
Intelligence Operations and Imagery Interpretation	41	44
Graphics	35	62
Still Photographic	65	76
Weather Forecaster	0	0
Airport Air Operations	18	29
Air Traffic Control Operator Technician	0	24
Radio Operator	6	65
Ground Radio Equipment Repair	50	62
Missile Electronic Equipment Specialist	59	74
Avionic Instrument Systems Specialist	9	35
Aircraft Electrical Systems Specialist	32	26
Aircraft Fuel Systems Mechanic	62	76
Jet Engine Mechanic	59	79
LGM 25 Missile Mechanic	53	62
Munitions Maintenance	65	79
Weapons Mechanic	32	65
Missile Facilities	53	68
Electrician	53	68
Electrical Power Production	50	65
Carpentry and Masonry Specialist	53	59
Fire Protection	38	26
Vehicle Operator/Dispatcher	32	41
Air Passenger and Air Cargo Specialist	32	18
Supply Services	68	74
Fuels Specialist	56	76
Inventory Management, Materiel Facilities and Supply Systems	38	56
Procurement Specialist	18	29
Chapel Management	53	74
Airman Administration	53	74
Legal Services	26	59
Personnel	18	56
Information Specialist	38	68
Medical Services	76	85
Dental and Preventive Dentistry Technician	59	71

* PQV = Performance Quality Variability

Table 4-29

Intercorrelation Matrix of Amount Ratings Across AFSCs and Tasks for Each Ability

	FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
FD	1.00	0.77	0.49	0.26	0.41	0.41	0.40	-0.12	-0.12	-0.04	0.19	-0.22	0.41
MD	-	1.00	0.71	0.51	0.39	0.45	0.53	0.18	0.10	-0.43	0.45	-0.20	0.67
CP	-	-	1.00	0.78	0.39	0.58	0.73	0.65	0.62	-0.35	0.63	0.15	0.84
RC	-	-	-	1.00	0.42	0.48	0.63	0.62	0.60	-0.32	0.79	0.40	0.78
VM	-	-	-	-	1.00	0.80	0.71	0.17	0.18	0.17	0.52	0.43	0.49
VSA	-	-	-	-	-	1.00	0.89	0.30	0.31	0.09	0.59	0.45	0.62
PM	-	-	-	-	-	-	1.00	0.50	0.50	-0.19	0.71	0.41	0.79
AD	-	-	-	-	-	-	-	1.00	0.98	-0.24	0.65	0.49	0.61
AM	-	-	-	-	-	-	-	-	1.00	-0.17	0.68	0.50	0.61
CLP	-	-	-	-	-	-	-	-	-	1.00	-0.28	0.34	-0.36
DP	-	-	-	-	-	-	-	-	-	-	1.00	0.58	0.78
DA	-	-	-	-	-	-	-	-	-	-	-	1.00	0.28
KM	-	-	-	-	-	-	-	-	-	-	-	-	1.00

	N	%
≥.50< .99	35	45
≥.30< .49	20	26
≥.10< .29	9	12
<.10	14	18

These data suggest that a moderate degree of uniqueness exists among the ratings of the perceptual/psychomotor abilities for Air Force job tasks.

The intercorrelation matrix was factor analyzed by the principal components method with orthogonal rotation employing the SPSS PA2 package (Nie et al, 1975). Three factors emerged employing the eigenvalue of 1.00 or greater as the criterion for accepting a factor. The eigenvalues and respective cumulative proportion of variance were:

	Eigenvalue	Cumulative % of Variance
Factor I	6.71	51.6
Factor II	2.33	69.5
Factor III	1.86	83.8

The two abilities loading highest on each factor along with the respective loadings were:

	Abilities Loading Highest	Loading
Factor I	Auditory Discrimination	.96
	Auditory Memory	.93
Factor II	Visual Speed and Accuracy	.86
	Visual Memory	.85
Factor III	Manual Dexterity	.92
	Finger Dexterity	.69

Attempts to disturb this solution through oblique rather than orthogonal rotation produced no marked effect. The results of the factor analysis suggest, as was probably to be anticipated, a visual factor, an auditory factor, and a manual factor.

Reliability Analysis

It is well known that the reliability of ratings can be increased if multiple judges' ratings are averaged to yield a single measure. By pooling different judges' ratings into a composite measure, the reliability can be increased substantially, even with only a moderate increase in the number of judges. This point has been made explicit by Winer (1962) and by Cronbach, Gleser, Nanda, and Rajaratnam (1972). Recently, it has also been demonstrated that the averaged ratings of more judges are in fact more valid (Horowitz, Inouye, and Siegelman, 1979). Other things being equal, a measure that is less reliable cannot correlate as highly with an external criterion. As one increases the reliability of a judgment by averaging the ratings of an increasing number of judges, one can expect the resulting measure to correlate more highly with an external criterion.

For four of the AFSCs (one randomly selected from each aptitude area), the data of eight randomly selected supervisors and eight randomly selected subordinates were analyzed to determine interrater reliability. The analyses included four abilities and 15 tasks. Eight separate variance analyses were completed--four for subordinates and four for supervisory raters. Only amount data were considered. Table 4-30 presents the variance analytic model employed for each of the eight analyses. If an analysis of variance is performed employing the model presented as Table 4-30, then the reliability of a single judge may be estimated by formula 1. From Winer (1962), the formula is adapted as follows:

$$r_{(1)} = \frac{\text{MS between treatments - MS error}}{\text{MS between treatments} + (n-1)\text{ MS error}} \quad (1)$$

where: number of raters (judges) = 8

treatments = 4 abilities, 15 tasks = 60

To provide appropriate values for the formula, between-treatments variance was estimated by pooling across abilities, tasks, and the tasks-by-ability interaction (df= 59). Error variance was estimated by the interaction involving raters by tasks by abilities (df= 294). By application of the Spearman-Brown prediction formula, the reliability of any number of judges may also be estimated. For 24 judges the estimate is given by formula 2.

$$r_{(24)} = \frac{24(r_{(1)})}{1 + (24 - 1)(r_{(1)})} \quad (2)$$

where $r_{(1)}$ = reliability of a single judge

Table 4-30

ANOVA Model for Reliability Determination

Source of Variation	df	
Rater (S)	(n-1) =	7
Task (A)	(p-1) =	14
Ability (B)	(q-1) =	3
S x A	(n-1)(p-1) =	98
S x B	(n-1)(q-1) =	21
A x B	(p-1)(q-1) =	42
S x A x B	(n-1) (p-1) (q-1) =	294
TOTAL	npq-1	479

Table 4-31 presents reliability estimates for a single judge (r_1), the average of eight judges (r_8), 16 judges (r_{16}), and 24 judges (r_{24}). The results suggest that for the data analyzed here, acceptable reliabilities require about 24 raters.

Stability

Another view of the reliability of the data can be gained by examining the agreement between the mean data obtained in the pretest with that obtained in the major data collection effort for the two specialties, Munitions Maintenance and Fire Protection, which were common to both study aspects. The correlation was obtained between the categorical scale judgments of the two specialties pretested and those of the equivalent judgments from the final data collection. We note that changes in methods and scaling procedures will serve to reduce the level of such coefficients. The following results provide considerable support for the employed technique's reliability.

Fire Protection (571)	r
Amount	.78
Performance Quality Variability	.53
Munitions Maintenance (461)	
Amount	.81
Performance Quality Variability	.72

Rater Error

The use of human judgment (rating scale procedures) in the present case rests on the assumption that the human observer represents a suitable observational instrument and is capable of achieving precision and objectivity. While we have confidence in quantitative human judgments, we are also aware of sources of bias in such judgments. Accordingly, the effects of three types of rating error on the data were investigated. They include rating errors termed by Guilford (1954) as contrast, leniency, and halo.

The tendency for some raters to rate the ability required by a task against the rater's own level on the skill is called contrast error. For example, some raters who are high on manual dexterity might systematically tend to rate such tasks as requiring a low amount of this ability.

Table 4-31

Reliability of Subordinate and Supervisory Ratings for a Variety of Sample Sizes and AFSCs

Subordinates AFSC	No. of Judges (1)	(8)	(16)	(24)
Inventory Management, Materiel Facilities and Supply Systems (645X0)	.098	.465	.635	.723
Airman Administration (702X0)	.269	.746	.855	.898
Weapons Mechanic (462X0)	.184	.643	.783	.844
Jet Engine Mechanic (426X2)	.249	.726	.841	.888

Supervisors AFSC	No. of Judges (1)	(8)	(16)	(24)
Inventory Management, Materiel Facilities and Supply Systems (645X0)	.453	.869	.930	.952
Airman Administration (702X0)	.530	.900	.947	.964
Weapons Mechanic (462X0)	.152	.589	.741	.811
Jet Engine Mechanic (426X2)	.179	.636	.777	.840

Leniency error occurs when raters systematically judge some tasks or abilities to be high or low because they have some interest in the abilities or tasks. For example, there are "hard" raters and "easy" raters. Some raters may "lean over backwards" to avoid rating an ability as more important than it really is.

Halo error would occur in the present context when a judge, who rates a given task as high or low on a given ability tends to carry this judgment over to other abilities. One result of the halo effect is to force the ratings in the direction of a general impression.

The same data set as employed (AFSCs and raters) for the prior reliability analysis was employed in the analysis of rater error.

Eight separate variance analyses were completed, four for subordinates and four for supervisory raters, to define error sources. From a variance summary, it is possible to estimate the strength of association between the independent and dependent variables. This strength of association statistic was employed in the present case as a method for interpreting sources of variance in terms of the proportionate contribution of each source or order of importance (Kirk, 1968, pp. 126, 134, 198). Table 4-32 presents the formulas employed for estimating the strength of association (Kirk, 1968). Using the triple interaction variance as an estimate of residual variance, conclusions may be obtained with respect to main effects and first order interactions. Variance components are important in the interpretation of results since even trivial association among means may achieve statistical significance if the sample is sufficiently large. An association measure states whether or not effects are large or small independently of the statistical significance of F ratios.

Tables 4-33 and 4-34 present association values (w^2) indicating the proportion of variance in the dependent variable accounted for by each of the independent variables. Each dependent variable is a different specialty. Mean association values across four AFSCs appear in the last column of each of the tables. The last row of each of the tables indicates the total proportion of variance accounted for in each dependent variable. Table 4-33 includes the summary of the analysis of subordinate's data. Table 4-34 displays the results from the supervisor analysis.

Association values due to raters indicating leniency error was low to moderate across all analyses performed. Contrast bias evidenced in the rater-by-ability interactions was also low to moderate in seven of the eight analyses performed. Halo bias, evidenced by variance in the rater-by-task interaction, proved quite low for seven of the eight analyses.

Table 4-32

Formulas Employed for Estimating Strength of Association (w^2) Between Independent and Dependent Variables

---

(S) Rater: $$w^2_{X|S} = \frac{SS_S - (n-1)\ MS_{SAB}}{SS_{total} + MS_{SAB}}$$

(A) Task: $$w^2_{X|A} = \frac{SS_A - (p-1)\ MS_{SAB}}{SS_{total} + MS_{SAB}}$$

(B) Ability: $$w^2_{X|B} = \frac{SS_B - (q-1)\ MS_{SAB}}{SS_{total} + MS_{SAB}}$$

S x A: $$w^2_{X|SA} = \frac{SS_{SA} - (n-1)(p-1)\ MS_{SAB}}{SS_{total} + MS_{SAB}}$$

S x B: $$w^2_{X|SB} = \frac{SS_{SB} - (n-1)(q-1)\ MS_{SAB}}{SS_{total} + MS_{SAB}}$$

A x B: $$w^2_{X|AB} = \frac{SS_{AB}\ (p-1)(q-1)\ MS_{SAB}}{SS_{total} + MS_{SAB}}$$

Note: — S = Raters
A = Tasks
B = Abilities
n = 8 Raters
p = 15 Tasks
q = 4 Abilities

Table 4-33

Strength of Association (w^2) Between Independent and Dependent Variables for Subordinate Raters*

	AFSC Dependent Variable				
Independent Variable	4262	4620	6450	7020	Mean
Rater (S)	.214	.186	.262	.320	.2455
Tasks (A)	.034	.001	.018	.010	.0157
Abilities (B)	.093	.071	.010	.059	.0583
S x A	.000	.077	.079	.011	.0417
S x B	.172	.297	.383	.305	.2892
A x B	.029	.008	.000	.028	.0162
SUM (w_j^2)	.542	.640	.752	.733	.6666

*Negative entries were assigned a zero value (Kirk, 1968, P. 198)

Table 4-34

Strength of Association (w^2) Between Independent and Dependent Variables for Supervisory Raters*

	AFSC Dependent Variable				
Independent Variable	4262	4620	6430	7020	Mean
Rater (S)	.320	.180	.085	.437	.2555
Task (A)	.035	.009	.008	.013	.0163
Abilities (B)	.005	.042	.341	.071	.1147
S x A	.000	.116	.002	.005	.0307
S x B	.174	.211	.092	.273	.1875
A x B	.055	.023	.019	.067	.0410
SUM (w_j^2)	.589	.581	.547	.866	.6457

*Negative entries were assigned a zero value (Kirk, 1968, P. 198)

For the subordinates, contrast bias (which is percentage of variance in the rater-by-ability interaction) amounted to 28.9%; leniency error (which is variance in the rater main effect) amounted to 24.6%. Halo bias (which is variance in the rater-by-task interaction) amounted to only 4.2%.

When the supervisory ratings are considered (Table 4-34), contrast bias, measured by the rater-by-ability interaction, amounted to 18.7%; leniency error, measured by the rater main effect, amounted to 25.6%. Halo bias, measured by the rater-by-task interaction, amounted to only 3.1%.

V. SUMMARY AND CONCLUSIONS

Summary

In order to derive a perceptual/psychomotor skill taxonomy which could provide the basis for analyzing the perceptual/psychomotor requirements of various AFSCs, an extensive literature analysis was conducted. The analysis served to isolate perceptual/psychomotor descriptors which have been employed previously by others. These descriptors were reduced through an empirical analysis which compared each descriptor with a variety of screening criteria. The end result was a perceptual/psychomotor taxonomy which contained 13 classes: finger dexterity, manual dexterity, control precision, rate control (tracking), visual memory, visual speed and accuracy, position memory, auditory discrimination, auditory memory, clerical perception, depth perception, divided attention, and kinesthetic memory.

A method was devised which would allow development of data about the amount of each of the perceptual/psychomotor classes involved in the performance of the tasks of an AFSC, and the performance quality variability produced of each of the classes when the tasks of an AFSC are performed. The data collection method was modeled after the job inventory procedures developed and currently used by the Air Force. This procedure essentially involves a checklist of tasks which is completed by a job incumbent relative to a set of attributes. In the present case, the attributes were the taxonomic classes and each list contained a sample of the tasks performed in each AFSC investigated.

A pretest of the procedure indicated that the method yielded data possessing sufficient quality to meet the goal of the present work--to provide a description of the perceptual/psychomotor requirements of various AFSCs. The job incumbent raters (supervisors and subordinates) were able to understand the taxonomy, the scaling procedures, and the methods for responding. The results, based on data collected during the pretest phase, also suggested adequate test-retest reliability. Scaling procedure or rater variables (supervisor or subordinate) did not seem to affect the results. However, the pretest also indicated a number of areas of potential problems. These largely concerned range restriction and discriminating power. To cope with these problems during the major data collection effort, modifications were incorporated into the methods.

The revised methods were applied to collect perceptual/psychomotor requirements information about 35 AFSCs at 10 Air Force bases within the SAC, TAC, and MAC major commands. The task list for each specialty contained a sample of 60 tasks performed by incumbents in that specialty. The resultant data were analyzed to yield the "high" and the "low" perceptual/psychomotor ability requirements for each of the AFSCs involved. Across all 35 AFSCs considered, the four most highly rated perceptual/psychomotor abilities for both amount and performance quality variability were: visual memory, visual speed and accuracy, finger dexterity, and manual dexterity. The four lowest rated abilities for both rated aspects were: auditory memory, auditory discrimination, kinesthetic memory, and depth perception.

A high correlation (r = .97) was found between the ratings of "amount" and of "performance quality variability." This suggests that only one or the other of these factors need be included in future surveys of this type. As in the pretest, the correlation between the data yielded by supervisors and by subordinates was high. For the amount factor the correlation between the ratings made by the two sets of judges was .94; for the performance quality variability factor, the correlation was .90.

Indices of profile similarity indicated support for a contention that the perceptual/psychomotor requirements for most AFSCs are at least partially unique.

A reliability analysis indicated that about 24 raters are required to produce adequate stability within the techniques employed.

Sources of rater error--leniency, contrast, and halo--were investigated and found to be present but not to a large extent.

A factor analysis of the data indicated that the taxonomy can be described by three factors--a visual, an auditory, and a manual factor.

Conclusions

Within the limits of the present data set, the following conclusions seem warranted:

1. The taxonomy, here developed and employed, can provide a basis for describing the perceptual/psychomotor requirements of various AFSCs.
2. The methods and procedures, here developed and employed, seem to produce information of adequate quality and can be employed in future investigations of the present type.

3. The various AFSCs are somewhat, but not highly, independent relative to the perceptual/psychomotor abilities required for effective performance. No AFSC was free from perceptual/psychomotor requirements.
4. About 24 judges are required to produce adequate data stability within the techniques employed.
5. By extrapolation, the results of the present work can be employed as a basis for career classification and perceptual/psychomotor test development.

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APPENDIX A

Pretest Forms

SECTION I

AMOUNT OF PERCEPTUAL/ PSYCHOMOTOR ABILITY

Part 1

Your task is to judge how much of each of a set of perceptual/ psychomotor abilities is involved in a number of the duties in your career field. To provide this information you should:

1. Make sure you understand the definition of each ability which is defined in the "Perceptual/ Psychomotor Ability Definitions" list.
2. Read the first duty in the duty list (last page of this "Part"). Refer to the first ability definition, finger dexterity (FD), and decide how much is involved in performing the first duty. Enter your estimate in the first column. Use the amount scale below in making your judgment.

   Amount

   N = duty not performed in your squadron
   NR = performed, but ability is not required in duty performance
   1 = very little (0% - 20%)
   2 = some (21% - 40%)
   3 = moderate (41% - 60%)
   4 = considerable (61% - 80%)
   5 = very much (81% - 100%)

3. Repeat the same step for the second duty, and so on until every line in the finger dexterity column is filled in.
4. Evaluate all the duties for the second ability, manual dexterity, in the same manner. Enter your judgment for this ability in the second column.
5. Continue in this manner until every duty has been evaluated for all the abilities.
6. Refer to the ability definitions as often as necessary when making your judgments.

Instructions for Parts 1 and 2 in Section I of the pretest data collection forms.

7. An example of how to complete Part 1 is presented below. For the first ability, finger dexterity, the person making the judgment thought that "conducting inventories" requires "very little" finger dexterity. He considered finger dexterity to represent about 10% of the duty. Accordingly, he entered a "1" on the first line of the first column. For the second duty, "maintaining files," the rater thought that finger dexterity represents 35% of "maintaining files." Therefore, he wrote a "2" alongside the second duty in the first column.

Perceptual/Psychomotor Ability

Duty	1 FD	2 MD	3 CP	4 RC	5 VM	6 VSA	7 PM	8 AD	9 AM	10 CP	11 DP	12 DA	13 KM
1. Conducting inventories	1	2	2	NR	3	3	3	NR	NR	2	NR	NR	NR
2. Maintaining files	2	1	1	NR	1	3	2	NR	NR	4	NR	NR	NR

8. Raters sometimes make errors of judgment when using forms such as this. To avoid these errors:

   a. use the high and the low numbers (1 and 5) of the scale whenever appropriate

   b. avoid excessive use of the middle number (3) of the scale

   c. avoid assignment of the same value to all abilities in a duty

9. Enter "N" alongside any duty that is not performed in your squadron.

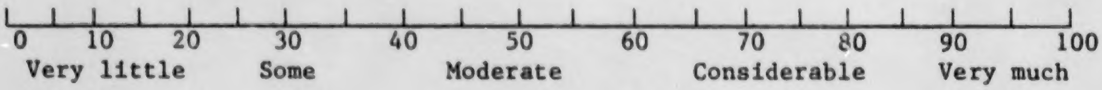
10. Enter "NR" in the box for any ability that is not required in the performance of the duty.

Part 2

In Part 2, your task is to judge again how much each of the set of perceptual/psychomotor abilities is involved in a number of the duties in your career field. To provide this information you should:

1. Make sure you understand the definition of each ability which is defined in the "Perceptual/Psychomotor Ability Definitions" list.

2. Read the first duty in the duty list (last page of this "Part"). Refer to the first ability definition, finger dexterity (FD), and decide how much is involved in performing the first duty. Enter your estimate in the first column. Use the amount scale below in making your judgment. You may use any value from zero to 100.



Amount

3. Repeat the same step for the second duty, and so on until every line in the finger dexterity column is filled in.

4. Evaluate all the duties for the second ability, manual dexterity, in the same manner. Enter your judgment for this ability in the second column.

5. Continue in this manner until every duty has been evaluated for all the abilities.

6. Refer to the ability definitions as often as necessary when making your judgments.

7. An example of how to complete Part 2 is presented below. For the first ability, finger dexterity, the person making the judgment thought that "conducting inventories" requires "very little" finger dexterity. Accordingly, he entered a "10" on the first line of the first column. For the second duty, "maintaining files," the rater thought that "some" amount of finger dexterity is involved. Therefore, he entered a "25" alongside the second duty in the first column.

Perceptual/Psychomotor Ability

Duty	1 FD	2 MD	3 CP	4 RC	5 VM	6 VSA	7 PM	8 AD	9 AM	10 CP	11 DP	12 DA	13 KM
1. Conducting inventories	10	35	40	NR	60	52	48	NR	NR	23	NR	NR	NR
2. Maintaining files	25	15	10	NR	5	50	30	NR	NR	60	NR	NR	NR

8. Raters sometimes make errors of judgment when using forms such as these. To avoid these errors:

   a. use the high (80 to 100) and the low numbers (0 to 20) of the scale whenever appropriate

   b. avoid excessive use of the middle numbers (45 to 55) of the scale

   c. avoid assignment of the same value to all abilities in a duty

9. Enter "N" alongside any duty that is not performed in your squadron.

10. Enter "NR" in the box for any ability that is not required in the performance of the duty.

SECTION II

PERFORMANCE QUALITY VARIABILITY AS A FUNCTION OF PERCEPTUAL/PSYCHOMOTOR ABILITY

Part 1

Your task in Section II is to judge how performance differences on a particular duty vary as a function of a specific perceptual/psychomotor ability. In completing the form, you should ask yourself the question: For a great number of people, how large are the differences in the performance of the duty, as a function of this specific ability? Your responses will provide information about the quality of performance, over large numbers of people. To provide this information you should:

1. Make sure you understand the definition of each ability which is defined in the "Perceptual/Psychomotor Ability Definitions" list.

2. Read the first duty in the duty list. Refer to the first ability definition, finger dexterity (FD), and decide on the extent of the performance difference which exists between people who perform the duty as a function of finger dexterity. Enter your estimate in the first column. Use the performance quality variability scale below in making your judgment.

Performance Quality Variability

N = duty not performed in your squadron
NR = performed, but ability is not required in duty performance
1 = quality of performance of this duty varies little, because of differences among current personnel in this ability
2 = quality of performance of this duty varies some because of differences among current personnel in this ability
3 = quality of performance of this duty varies moderately because of differences among current personnel in this ability
4 = quality of performance of this duty varies considerably because of differences among current personnel in this ability
5 = quality of performance of this duty varies to a very great extent because of differences among current personnel in this ability

Instructions for Parts 1 and 2 in Section II of the pretest data collection forms.

3. Repeat the same step for the second duty, and so on until every line in the finger dexterity column is filled in.

4. Evaluate all the duties for the second ability, manual dexterity in the same manner. Enter your judgment for this ability in the second column.

5. Continue in this manner until every duty has been evaluated for all the abilities.

6. Refer to the ability definitions as often as necessary when making your judgments.

7. An example of how to complete Part 1 is presented below. For the first ability, finger dexterity, the person making the judgment thought that quality of performance of the duty, "conducting inventories," varies "little" among current personnel because of differences in finger dexterity. Accordingly, he entered a "1" on the first line of the first column. For the second duty, "maintaining files," the rater thought that finger dexterity differences among current personnel have "some" effect on the quality of performance. Therefore, he wrote a "2" alongside the second duty in the first column.

Perceptual/Psychomotor Ability

Duty	1 FD	2 MD	3 CP	4 RC	5 VM	6 VSA	7 PM	8 AD	9 AM	10 CP	11 DP	12 DA	13 KM
1. Conducting inventories	1	2	2	NR	3	3	3	NR	NR	2	NR	NR	NR
2. Maintaining files	2	1	1	NR	1	3	2	NR	NR	4	NR	NR	NR

8. Raters sometimes make errors of judgment when using forms such as these. To avoid making these errors:

   a. use the high and the low numbers (1 and 5) of the scale whenever appropriate

   b. avoid excessive use of the middle number (3) of the scale

   c. avoid assignment of the same value to all abilities in a duty

9. Enter "N" alongside any duty that is not performed in your squadron.

10. Enter "NR" in the box for any ability that is not required in the performance of the duty.

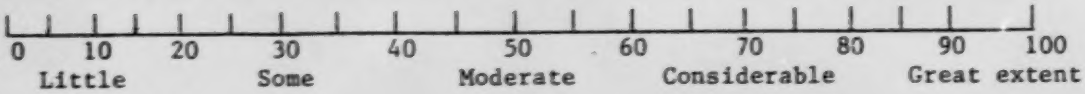
Part 2

In Part 2, your task is to judge again how performance differences on a particular duty vary as a function of a specific perceptual/psychomotor ability. In completing the form, you should ask yourself the question: For a great number of people, how large are the differences in the performance of the duty, as a function of this specific ability? Your responses will provide information about the quality of performance, over large numbers of people. To provide this information you should:

1. Make sure you understand the definition of each ability which is defined in the "Perceptual/Psychomotor Ability Definitions" list.

2. Read the first duty in the duty list. Refer to the first ability definition, finger dexterity (FD), and decide on the extent of the performance difference which exists between people who perform the duty as a function of finger dexterity. Enter your estimate in the first column. Use the performance quality variability scale below in making your judgment. You may use any value from zero to 100.

Performance Quality Variability



3. Repeat the same step for the second duty, and so on until every line in the finger dexterity column is filled in.

4. Evaluate all the duties for the second ability, manual dexterity, in the same manner. Enter your judgment for this ability in the second column.

5. Continue in this manner until every duty has been evaluated for all the abilities.

6. Refer to the ability definitions as often as necessary when making your judgments.

7. An example of how to complete Part 2 is presented below. For the first ability, finger dexterity, the person thought that quality of performance of the duty, "conducting inventories," varies a "little" amount among current personnel because of differences in finger dexterity. Accordingly, he entered a "10" on the first line of the first column. For the second duty, "maintaining files," the rater thought that finger dexterity differences among current personnel have "some" effect on the quality of performance. Therefore, he wrote "25" alongside the second duty in the first column.

	Perceptual/Psychomotor Ability												
Duty	1 FD	2 MD	3 CP	4 RC	5 VM	6 VSA	7 PM	8 AD	9 AM	10 CP	11 DP	12 DA	13 KM
1. Conducting inventories	10	35	40	NR	60	52	48	NR	NR	23	NR	NR	NR
2. Maintaining files	25	15	10	NR	5	50	30	NR	NR	80	NR	NR	NR

8. Raters sometimes make errors of judgment when using forms such as these. To avoid making these errors:

   a. use the high (80 to 100) and the low (0 to 20) ends of the scale whenever appropriate

   b. avoid excessive use of the central area of the scale (45 to 55)

   c. avoid assignment of the same value to all abilities in a duty

9. Enter "N" alongside those duties that are not performed in your squadron.

10. Enter "NR" in the box for any ability that is not required in the performance of the duty.

The response sheets were arranged with the 13 perceptual/psychomotor abilities in vertical columns, with legends across the top of the page. The tasks were identified along the left side of the page. A sample response sheet is shown in Exhibit A-1. In order to balance the effects of fatigue and practice, the sequence of tasks in each of the two parts in each survey form section, were reversed. Accordingly, tasks ordered from 1 to 20 in Part 1 of the two sections were ordered from the twentieth task first to the first task list in the second part of the survey form.

571 Amount

	Perceptual/Psychomotor Ability												
Duty	1 FD	2 MD	3 CP	4 RC	5 VM	6 VSA	7 FM	8 AD	9 AM	10 CLP	11 DP	12 DA	13 KM
1. Inspect aircraft parking areas													
2. Load hoses or make hose load finishes													
3. Operate nozzles													
4. Dry hoses													
5. Perform reverse hose lays													
6. Operate extinguishers													
7. Operate powered wood or masonry saws													
8. Position or operate smoke ejectors													
9. Perform siamese or wye connection hose lays													
10. Select fire extinguishing agents to be used													
11. Establish equipment positions													
12. Establish positions to fight fires													
13. Inspect hoses, connections, or nozzles													
14. Inspect fire alarm receiving or recording equipment													
15. Maintain records of building locations, fire hydrant locations, or approach routes													
16. Maintain fire station logs													
17. Operate intercom systems													
18. Receive, transmit, or record administrative calls													
19. Operate telephone switchboards													
20. Alert firefighting crews													

Exhibit A-1. Sample response page from the data collection forms.

APPENDIX B

Interview Form Used In Pretest

PERCEPTUAL/PSYCHOMOTOR REQUIREMENTS INTERVIEW

Name______________________________ Date______________

Rank____________ Squadron____________ Location____________

Career Field________________________

I HAVE A SHORT INTERVIEW WHICH WILL, IN PART, BE BASED ON THE FORM YOU COMPLETED. YOUR ANSWERS WILL BE HELD CONFIDENTIAL. THE DATA WILL BE TREATED STATISTICALLY AND YOUR NAME WILL NOT BE ASSOCIATED WITH IT IN ANY WAY. THANK YOU FOR YOUR COOPERATION.

1. (show card) How long have you been in (career field) ____________________?

   ______(1) Less than 6 months
   ______(2) Between 6 months and 1 year
   ______(3) 1 to 3 years
   ______(4) 3 to 5 years
   ______(5) More than 5 years

2. (show card) How long have you been stationed at ______________?

   ______(1) Less than 6 months
   ______(2) Between 6 months and 1 year
   ______(3) 1 to 3 years
   ______(4) 3 to 5 years
   ______(5) More than 5 years

3. (show card) How long have you been in the Air Force?

   ______(1) Less than 6 months
   ______(2) Between 6 months and 1 year
   ______(3) 1 to 3 years
   ______(4) 4 to 5 years
   ______(5) More than 5 years

4. (show card) What other perceptual/psychomotor abilities that were not included in the list, are required in performing the the duties listed in the questionnaire?

5. (show card) ____

   ____

   ____

5. (show card) Are there any perceptual/psychomotor abilities that may be required at some locations or duty stations that would not be required at others? Which and how so?

   ____

   ____

   ____

6. (show card) Which perceptual/psychomotor abilities were not meaningful to you? How so?

____

____

____

____

____

7. (show card) Which two statements best describes your opinion of the categorical questionnaire (identify)? The magnitude questionnaire (identify)?

	Categorical	Magnitude
A good approach	____	____
Unclear	____	____
Difficult to see	____	____
Provides inadequate information	____	____
Easy to use	____	____
Poor approach	____	____
Hard to understand	____	____
Provides a lot of information	____	____
Easy to interpret	____	____
Clear	____	____

8. (show card) In general, how difficult was it for you to complete the categorical questionnaire? The magnitude questionnaire?

	Categorical	Magnitude
Very difficult	____	____
Moderately difficult	____	____
Neither difficult or easy	____	____
Moderately easy	____	____
Very easy	____	____

9. Do you have any suggestions that would be helpful to us for improving the form that you completed so that it will be more useable?

10. Please provide a judgment indicating the amount that each perceptual/ psychomotor ability is involved in each of the following duties. (Provide definitions. Enter responses on the answer sheets for the interviewee. Within each career field half the interviewees use the categorical scale and half use the magnitude estimation scale).

11. Please provide a judgment indicating how large the differences in performance varies as a function of the specific ability. (Provide definitions. Enter responses on the answer sheets for the interviewee. Within each career field, those interviewees who received the categorical scale in item 10 should receive the same scale for this exercise. Similarly, those who used the magnitude estimation scale in item 10 should use it again for this item).

APPENDIX C

Correlations Among Abilities For Pretest

Table C-1

Intercorrelations Among Abilities for Fire Protection (571XX) Supervisors on Amount-Categorical Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.63	0.53	0.46	0.58	0.41	0.68	0.31	0.42	0.26	0.13	0.45	0.52
0.63	1.00	0.73	0.55	0.31	0.44	0.58	0.52	0.42	0.15	0.23	0.11	0.12
0.53	0.73	1.00	0.58	0.39	0.49	0.76	0.44	0.41	0.02	0.30	0.24	0.34
0.46	0.55	0.58	1.00	0.36	0.48	0.68	0.49	0.36	0.28	0.40	0.50	0.42
0.58	0.31	0.39	0.36	1.00	0.43	0.58	0.06	0.37	0.46	0.25	0.46	0.20
0.41	0.44	0.49	0.48	0.43	1.00	0.63	0.60	0.43	0.15	0.34	0.45	0.27
0.68	0.58	0.76	0.68	0.58	0.63	1.00	0.53	0.50	0.29	0.31	0.54	0.46
0.31	0.52	0.44	0.49	0.06	0.60	0.53	1.00	0.48	0.09	0.39	0.42	0.37
0.42	0.42	0.41	0.36	0.37	0.43	0.50	0.48	1.00	0.12	0.33	0.54	0.29
0.26	0.15	0.02	0.28	0.46	0.15	0.29	0.09	0.12	1.00	0.30	0.36	0.08
0.13	0.23	0.30	0.40	0.25	0.34	0.31	0.39	0.33	0.30	1.00	0.36	0.22
0.45	0.11	0.24	0.50	0.46	0.45	0.54	0.42	0.54	0.36	0.36	1.00	0.63
0.52	0.12	0.34	0.42	0.20	0.27	0.46	0.37	0.29	0.08	0.22	0.63	1.00

Table C-2

Intercorrelations Among Abilities for Fire Protection (571XX) Subordinates on Amount-Categorical Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.74	0.62	0.34	0.55	0.34	0.39	0.25	0.25	0.50	0.36	0.49	0.55
0.74	1.00	0.81	0.38	0.83	0.56	0.66	0.39	0.38	0.50	0.42	0.47	0.40
0.62	0.81	1.00	0.53	0.85	0.73	0.81	0.56	0.57	0.69	0.64	0.58	0.51
0.34	0.38	0.53	1.00	0.34	0.47	0.35	0.61	0.59	0.42	0.49	0.22	0.07
0.55	0.83	0.85	0.34	1.00	0.71	0.85	0.43	0.43	0.55	0.41	0.51	0.47
0.34	0.56	0.73	0.47	0.71	1.00	0.87	0.70	0.69	0.73	0.55	0.62	0.48
0.39	0.66	0.81	0.35	0.85	0.87	1.00	0.70	0.73	0.75	0.53	0.68	0.59
0.25	0.39	0.56	0.61	0.43	0.70	0.70	1.00	0.95	0.60	0.55	0.46	0.41
0.25	0.38	0.57	0.59	0.43	0.69	0.73	0.95	1.00	0.72	0.67	0.56	0.50
0.50	0.50	0.69	0.42	0.55	0.73	0.75	0.60	0.72	1.00	0.70	0.77	0.70
0.36	0.42	0.64	0.49	0.41	0.55	0.53	0.55	0.67	0.70	1.00	0.59	0.60
0.49	0.47	0.58	0.22	0.51	0.62	0.68	0.46	0.56	0.77	0.59	1.00	0.67
0.55	0.40	0.51	0.07	0.47	0.48	0.59	0.41	0.50	0.70	0.60	0.67	1.00

Table C-3

Intercorrelations Among Abilities for Munitions Maintenance (461XX) Supervisors on Amount-Categorical Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.47	0.45	-0.13	0.09	0.05	-0.06	-0.13	-0.19	-0.05	0.06	0.05	-0.09
0.47	1.00	0.57	-0.10	0.16	0.11	0.22	-0.02	-0.23	0.14	0.01	0.30	0.09
0.45	0.57	1.00	0.31	0.01	-0.09	-0.27	-0.07	-0.37	0.18	-0.13	0.49	-0.12
-0.13	-0.10	0.31	1.00	-0.32	-0.31	-0.34	-0.14	-0.31	-0.05	0.18	0.24	-0.31
0.09	0.16	0.01	-0.32	1.00	0.76	0.69	-0.03	0.66	0.17	0.27	-0.26	0.59
0.05	0.11	-0.09	-0.31	0.76	1.00	0.81	0.00	0.54	-0.07	0.24	-0.28	0.46
-0.06	0.22	-0.27	-0.34	0.69	0.81	1.00	0.07	0.55	0.07	0.30	-0.26	0.56
-0.13	-0.02	-0.07	-0.14	-0.03	0.00	0.07	1.00	0.37	0.48	-0.16	0.15	0.08
-0.19	-0.23	-0.37	-0.31	0.66	0.54	0.55	0.37	1.00	0.37	0.36	-0.23	0.62
-0.05	0.14	0.18	-0.05	0.17	-0.07	0.07	0.48	0.37	1.00	0.20	0.54	0.20
0.06	0.01	-0.13	0.18	0.27	0.24	0.30	-0.16	0.36	0.20	1.00	0.05	0.42
0.05	0.30	0.49	0.24	-0.26	-0.28	-0.26	0.15	-0.23	0.54	0.05	1.00	-0.09
-0.09	0.09	-0.12	-0.31	0.59	0.46	0.56	0.08	0.62	0.20	0.42	-0.09	1.00

Table C-4

Intercorrelations Among Abilities for Munitions Maintenance (461XX) Subordinates on Amount-Categorical Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.40	0.19	0.23	0.19	0.29	0.28	0.21	0.22	0.03	0.27	0.16	0.09
0.40	1.00	0.44	0.13	0.42	0.54	0.20	0.21	-0.13	0.38	0.49	-0.06	-0.16
0.19	0.44	1.00	0.69	0.16	0.42	0.49	0.43	0.14	0.32	0.45	0.16	0.14
0.23	0.13	0.69	1.00	0.01	0.21	0.22	0.27	0.26	-0.02	0.15	0.30	0.23
0.19	0.42	0.16	0.01	1.00	0.54	0.50	0.41	0.27	0.05	0.29	0.64	0.42
0.29	0.54	0.42	0.21	0.54	1.00	0.60	0.74	0.41	0.43	0.67	0.52	0.39
0.28	0.20	0.49	0.22	0.50	0.60	1.00	0.69	0.44	0.51	0.65	0.46	0.59
0.21	0.21	0.43	0.27	0.41	0.74	0.69	1.00	0.67	0.39	0.41	0.55	0.59
0.22	-0.13	0.14	0.26	0.27	0.41	0.44	0.67	1.00	0.07	0.18	0.45	0.70
0.03	0.38	0.32	-0.02	0.05	0.43	0.51	0.39	0.07	1.00	0.61	-0.22	0.16
0.27	0.49	0.45	0.15	0.29	0.67	0.65	0.41	0.18	0.61	1.00	0.16	0.33
0.16	-0.06	0.16	0.30	0.64	0.52	0.46	0.55	0.45	-0.22	0.16	1.00	0.57
0.09	-0.16	0.14	0.23	0.42	0.39	0.59	0.59	0.70	0.16	0.33	0.57	1.00

Table C-5

Intercorrelations Among Abilities for Fire Protection (571XX) Supervisors on Amount-Magnitude Estimation Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.80	0.81	0.60	0.72	0.73	0.77	0.61	0.59	0.36	0.60	0.57	0.47
0.80	1.00	0.74	0.51	0.55	0.55	0.62	0.54	0.45	0.33	0.38	0.40	0.32
0.81	0.74	1.00	0.61	0.59	0.60	0.63	0.44	0.40	0.27	0.48	0.45	0.35
0.60	0.51	0.61	1.00	0.46	0.52	0.49	0.45	0.52	0.24	0.61	0.75	0.56
0.72	0.55	0.59	0.46	1.00	0.66	0.70	0.54	0.64	0.32	0.67	0.70	0.47
0.73	0.55	0.60	0.52	0.66	1.00	0.86	0.55	0.64	0.13	0.60	0.47	0.43
0.77	0.62	0.63	0.49	0.70	0.86	1.00	0.64	0.63	0.39	0.65	0.55	0.46
0.61	0.54	0.44	0.45	0.54	0.55	0.64	1.00	0.81	0.12	0.58	0.37	0.27
0.59	0.45	0.40	0.52	0.64	0.64	0.63	0.81	1.00	0.05	0.76	0.57	0.47
0.36	0.33	0.27	0.24	0.32	0.13	0.39	0.12	0.05	1.00	0.26	0.51	0.38
0.60	0.38	0.48	0.61	0.67	0.60	0.65	0.58	0.76	0.26	1.00	0.72	0.67
0.57	0.40	0.45	0.75	0.70	0.47	0.55	0.37	0.57	0.51	0.72	1.00	0.73
0.47	0.32	0.35	0.56	0.47	0.43	0.46	0.27	0.47	0.38	0.67	0.73	1.00

Table C-6

Intercorrelations Among Abilities for Fire Protection (571XX) Subordinates on Amount-Magnitude Estimation Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CP	DP	DA	KM
1.00	0.77	0.64	0.23	0.48	0.24	0.34	0.17	0.12	0.05	0.22	0.11	0.32
0.77	1.00	0.77	0.53	0.67	0.48	0.53	0.42	0.37	0.25	0.46	0.45	0.37
0.64	0.77	1.00	0.76	0.77	0.66	0.70	0.59	0.60	0.55	0.71	0.62	0.53
0.23	0.53	0.76	1.00	0.57	0.59	0.60	0.67	0.78	0.63	0.87	0.66	0.30
0.48	0.67	0.77	0.57	1.00	0.88	0.93	0.82	0.75	0.72	0.63	0.67	0.69
0.24	0.48	0.66	0.59	0.88	1.00	0.95	0.90	0.84	0.79	0.67	0.80	0.61
0.34	0.53	0.70	0.60	0.93	0.95	1.00	0.92	0.85	0.76	0.66	0.75	0.70
0.17	0.42	0.59	0.67	0.82	0.90	0.92	1.00	0.96	0.79	0.75	0.77	0.62
0.12	0.37	0.60	0.78	0.75	0.84	0.85	0.96	1.00	0.79	0.84	0.73	0.50
0.05	0.25	0.55	0.63	0.72	0.79	0.76	0.79	0.79	1.00	0.78	0.76	0.55
0.22	0.46	0.71	0.87	0.63	0.67	0.66	0.75	0.84	0.78	1.00	0.67	0.37
0.11	0.45	0.62	0.66	0.67	0.80	0.75	0.77	0.73	0.76	0.67	1.00	0.61
0.32	0.37	0.53	0.30	0.69	0.61	0.70	0.62	0.50	0.55	0.37	0.61	1.00

Table C-7

Intercorrelations Among Abilities for Munitions Maintenance (461XX) Supervisors on Amount-Magnitude Estimation Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.53	-0.08	-0.42	0.09	-0.00	0.05	-0.31	-0.28	-0.14	0.12	-0.25	-0.09
0.53	1.00	0.21	-0.20	0.15	-0.04	-0.20	-0.43	-0.31	0.11	-0.04	0.15	-0.09
-0.08	0.21	1.00	0.72	-0.00	0.22	0.07	-0.04	-0.10	0.46	0.09	0.54	0.20
-0.42	-0.20	0.72	1.00	0.17	0.09	0.05	0.17	0.13	0.33	0.12	0.58	0.22
0.09	0.15	-0.00	0.17	1.00	0.16	0.21	0.16	0.63	0.15	0.37	0.04	0.23
-0.00	-0.04	0.22	0.09	0.16	1.00	0.59	0.62	0.31	0.80	-0.01	0.24	0.18
0.05	-0.20	0.07	0.05	0.21	0.59	1.00	0.49	0.19	0.38	-0.04	0.21	0.21
-0.31	-0.43	-0.04	0.17	0.16	0.62	0.49	1.00	0.70	0.34	0.20	-0.01	0.28
-0.28	-0.31	-0.10	0.13	0.63	0.31	0.19	0.70	1.00	0.12	0.38	-0.15	0.21
-0.14	0.11	0.46	0.33	0.15	0.80	0.38	0.34	0.12	1.00	-0.20	0.37	-0.00
0.12	-0.04	0.09	0.12	0.37	-0.01	-0.04	0.20	0.38	-0.20	1.00	0.07	0.42
-0.25	0.15	0.54	0.58	0.04	0.24	0.21	-0.01	-0.15	0.37	0.07	1.00	0.40
-0.09	-0.09	0.20	0.22	0.23	0.18	0.21	0.28	0.21	-0.00	0.42	0.40	1.00

Table C-8

Intercorrelations Among Abilities for Munitions Maintenance (461XX) Subordinates on Amount-Magnitude Estimation Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.66	0.29	0.58	0.57	0.52	0.43	0.09	0.06	0.14	0.01	0.02	-0.15
0.66	1.00	0.71	0.54	0.45	0.65	0.46	-0.02	-0.02	0.46	0.30	-0.20	-0.38
0.29	0.71	1.00	0.42	0.41	0.47	0.54	-0.09	-0.22	0.67	0.47	-0.21	-0.39
0.58	0.54	0.42	1.00	0.32	0.09	0.23	0.32	0.03	0.14	-0.01	0.11	-0.17
0.57	0.45	0.41	0.32	1.00	0.45	0.69	0.14	-0.01	0.41	0.31	0.21	-0.07
0.52	0.65	0.47	0.09	0.45	1.00	0.62	-0.04	-0.04	0.54	0.34	-0.16	-0.16
0.43	0.46	0.54	0.23	0.69	0.62	1.00	0.14	-0.10	0.67	0.37	0.20	0.09
0.09	-0.02	-0.09	0.32	0.14	-0.04	0.14	1.00	0.64	-0.06	0.03	0.57	0.41
0.06	-0.02	-0.22	0.03	-0.01	-0.04	-0.10	0.64	1.00	-0.11	0.03	0.45	0.47
0.14	0.46	0.67	0.14	0.41	0.54	0.67	-0.06	-0.11	1.00	0.51	-0.34	-0.20
0.01	0.30	0.47	-0.01	0.31	0.34	0.37	0.03	0.03	0.51	1.00	0.13	0.01
0.02	-0.20	-0.21	0.11	0.21	-0.16	0.20	0.57	0.45	-0.34	0.13	1.00	0.74
-0.15	-0.38	-0.39	-0.17	-0.07	-0.16	0.09	0.41	0.47	-0.20	0.01	0.74	1.00

Table C-9

Intercorrelations Among Abilities for Fire Protection (571XX) Supervisors on Performance Quality Variability-Categorical Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.70	0.43	0.40	0.38	0.18	0.55	0.47	0.47	0.23	0.81	0.77	0.79
0.70	1.00	0.77	0.64	0.54	0.40	0.67	0.47	0.45	0.34	0.61	0.50	0.56
0.43	0.77	1.00	0.75	0.72	0.54	0.72	0.27	0.30	0.50	0.35	0.28	0.34
0.40	0.64	0.75	1.00	0.68	0.53	0.71	0.53	0.52	0.40	0.42	0.41	0.50
0.38	0.54	0.72	0.68	1.00	0.64	0.86	0.61	0.64	0.44	0.33	0.43	0.35
0.18	0.40	0.54	0.53	0.64	1.00	0.82	0.48	0.53	0.42	0.07	0.10	0.14
0.55	0.67	0.72	0.71	0.86	0.82	1.00	0.66	0.68	0.38	0.43	0.46	0.45
0.47	0.47	0.27	0.53	0.61	0.48	0.66	1.00	0.94	0.34	0.56	0.57	0.56
0.47	0.45	0.30	0.52	0.64	0.53	0.68	0.94	1.00	0.32	0.58	0.56	0.55
0.23	0.34	0.50	0.40	0.44	0.42	0.38	0.34	0.32	1.00	0.28	0.24	0.23
0.81	0.61	0.35	0.42	0.33	0.07	0.43	0.56	0.58	0.28	1.00	0.84	0.83
0.77	0.50	0.28	0.41	0.43	0.10	0.46	0.57	0.56	0.24	0.84	1.00	0.89
0.79	0.56	0.34	0.50	0.35	0.14	0.45	0.56	0.55	0.23	0.83	0.89	1.00

Table C-10

Intercorrelations Among Abilities for Fire Protection (571XX) Subordinates on Performance Quality Variability-Categorical Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.90	0.72	0.53	0.68	0.45	0.53	0.20	0.19	0.02	0.19	0.29	0.58
0.90	1.00	0.79	0.55	0.69	0.47	0.60	0.34	0.25	-0.03	0.28	0.26	0.50
0.72	0.79	1.00	0.79	0.83	0.59	0.72	0.65	0.56	0.35	0.47	0.51	0.72
0.58	0.55	0.79	1.00	0.76	0.70	0.54	0.63	0.70	0.57	0.59	0.61	0.65
0.68	0.69	0.83	0.76	1.00	0.80	0.82	0.57	0.54	0.45	0.36	0.61	0.79
0.45	0.47	0.59	0.70	0.80	1.00	0.78	0.62	0.64	0.62	0.63	0.67	0.57
0.53	0.60	0.72	0.54	0.82	0.78	1.00	0.60	0.44	0.33	0.48	0.39	0.56
0.20	0.34	0.65	0.63	0.57	0.62	0.60	1.00	0.90	0.59	0.64	0.54	0.55
0.19	0.25	0.56	0.70	0.54	0.64	0.44	0.90	1.00	0.68	0.71	0.63	0.57
0.02	-0.03	0.35	0.57	0.45	0.62	0.33	0.59	0.68	1.00	0.47	0.77	0.49
0.19	0.28	0.47	0.59	0.36	0.63	0.48	0.64	0.71	0.47	1.00	0.53	0.27
0.29	0.26	0.51	0.61	0.61	0.67	0.39	0.54	0.63	0.77	0.53	1.00	0.65
0.58	0.50	0.72	0.65	0.79	0.57	0.56	0.55	0.57	0.49	0.27	0.65	1.00

Table C-11

Intercorrelations Among Abilities for Munitions Maintenance (461XX) Supervisors on Performance Quality Variability-Categorical Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.80	0.73	0.71	0.55	0.72	0.75	0.30	0.39	0.48	0.50	0.56	0.48
0.80	1.00	0.89	0.60	0.68	0.65	0.72	0.34	0.38	0.56	0.47	0.55	0.53
0.73	0.89	1.00	0.71	0.75	0.56	0.70	0.37	0.29	0.59	0.40	0.59	0.49
0.71	0.60	0.71	1.00	0.60	0.51	0.59	0.32	0.33	0.48	0.55	0.53	0.55
0.55	0.68	0.75	0.60	1.00	0.76	0.85	0.39	0.51	0.80	0.59	0.71	0.65
0.72	0.65	0.56	0.51	0.76	1.00	0.83	0.26	0.51	0.64	0.57	0.57	0.52
0.75	0.72	0.70	0.59	0.85	0.83	1.00	0.34	0.50	0.78	0.70	0.70	0.60
0.30	0.34	0.37	0.32	0.39	0.26	0.34	1.00	0.52	0.23	0.55	0.26	0.53
0.39	0.38	0.29	0.33	0.51	0.51	0.50	0.52	1.00	0.20	0.38	0.08	0.68
0.48	0.56	0.59	0.48	0.80	0.64	0.78	0.23	0.20	1.00	0.62	0.64	0.30
0.50	0.47	0.40	0.55	0.59	0.57	0.70	0.55	0.38	0.62	1.00	0.62	0.60
0.56	0.55	0.59	0.53	0.71	0.57	0.70	0.26	0.08	0.64	0.62	1.00	0.62
0.48	0.53	0.49	0.55	0.65	0.52	0.60	0.53	0.68	0.30	0.60	0.62	1.00

Table C-12

Intercorrelations Among Abilities for Munitions Maintenance (461XX) Subordinates on Performance Quality Variability-Categorical Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.56	0.51	0.15	0.25	0.36	0.22	0.02	-0.05	0.07	0.14	-0.11	-0.00
0.56	1.00	0.27	0.42	0.39	0.21	0.21	0.37	0.41	0.13	0.03	0.14	0.26
0.51	0.27	1.00	0.41	0.56	0.73	0.62	0.22	0.33	0.44	0.56	0.19	0.25
0.15	0.42	0.41	1.00	0.57	0.65	0.59	0.49	0.60	0.51	0.55	0.46	0.50
0.26	0.39	0.56	0.57	1.00	0.75	0.81	0.58	0.64	0.72	0.58	0.62	0.77
0.36	0.21	0.73	0.65	0.75	1.00	0.89	0.59	0.58	0.85	0.86	0.60	0.59
0.22	0.21	0.62	0.59	0.81	0.89	1.00	0.68	0.61	0.87	0.86	0.73	0.79
0.02	0.37	0.22	0.49	0.58	0.59	0.68	1.00	0.88	0.74	0.67	0.81	0.78
-0.05	0.41	0.33	0.60	0.64	0.58	0.61	0.88	1.00	0.64	0.61	0.69	0.71
0.07	0.13	0.44	0.51	0.72	0.85	0.87	0.74	0.64	1.00	0.86	0.79	0.74
0.14	0.03	0.56	0.55	0.58	0.86	0.86	0.67	0.61	0.86	1.00	0.69	0.71
-0.11	0.14	0.19	0.46	0.62	0.60	0.73	0.81	0.69	0.79	0.69	1.00	0.83
-0.00	0.26	0.25	0.50	0.77	0.59	0.79	0.78	0.71	0.74	0.71	0.83	1.00

Table C-13

Intercorrelations Among Abilities for Fire Protection (571XX) Supervisors on Performance Quality Variability-Magnitude Estimation Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.90	0.70	0.55	0.45	0.67	0.64	0.49	0.48	0.37	0.60	0.58	0.62
0.90	1.00	0.85	0.75	0.62	0.73	0.72	0.63	0.64	0.32	0.67	0.55	0.63
0.70	0.85	1.00	0.77	0.66	0.79	0.70	0.58	0.63	0.25	0.79	0.42	0.53
0.55	0.75	0.77	1.00	0.41	0.60	0.40	0.59	0.64	0.36	0.62	0.34	0.33
0.45	0.62	0.66	0.41	1.00	0.70	0.86	0.59	0.62	0.14	0.60	0.49	0.65
0.67	0.73	0.79	0.60	0.70	1.00	0.73	0.62	0.65	0.35	0.71	0.29	0.43
0.64	0.72	0.70	0.40	0.86	0.73	1.00	0.56	0.53	0.21	0.67	0.51	0.69
0.49	0.63	0.58	0.59	0.59	0.62	0.56	1.00	0.94	0.30	0.60	0.47	0.68
0.48	0.64	0.63	0.64	0.62	0.65	0.53	0.94	1.00	0.36	0.53	0.40	0.61
0.37	0.32	0.25	0.36	0.14	0.35	0.21	0.30	0.36	1.00	0.11	0.21	0.07
0.60	0.67	0.79	0.62	0.60	0.71	0.67	0.60	0.53	0.11	1.00	0.55	0.63
0.58	0.55	0.42	0.34	0.49	0.29	0.51	0.47	0.40	0.21	0.55	1.00	0.82
0.62	0.63	0.53	0.33	0.65	0.43	0.69	0.68	0.61	0.07	0.63	0.82	1.00

Table C-14

Intercorrelations Among Abilities for Fire Protection (571XX) Subordinates on Performance Quality Variability-Magnitude Estimation Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.87	0.79	0.66	0.79	0.82	0.80	0.61	0.65	0.47	0.67	0.48	0.61
0.87	1.00	0.92	0.83	0.84	0.78	0.81	0.77	0.72	0.57	0.70	0.55	0.71
0.79	0.92	1.00	0.82	0.84	0.72	0.77	0.77	0.77	0.65	0.67	0.66	0.74
0.66	0.83	0.82	1.00	0.75	0.66	0.71	0.62	0.61	0.61	0.82	0.68	0.77
0.79	0.84	0.84	0.75	1.00	0.90	0.88	0.70	0.69	0.49	0.76	0.65	0.79
0.82	0.78	0.72	0.66	0.90	1.00	0.94	0.72	0.70	0.50	0.78	0.70	0.76
0.80	0.81	0.77	0.71	0.88	0.94	1.00	0.78	0.74	0.57	0.85	0.73	0.79
0.61	0.77	0.77	0.62	0.70	0.72	0.78	1.00	0.94	0.73	0.61	0.65	0.71
0.65	0.72	0.77	0.61	0.69	0.70	0.74	0.94	1.00	0.79	0.58	0.63	0.63
0.47	0.57	0.65	0.61	0.49	0.50	0.57	0.73	0.79	1.00	0.64	0.71	0.47
0.67	0.70	0.67	0.82	0.76	0.78	0.85	0.61	0.58	0.64	1.00	0.77	0.73
0.48	0.55	0.66	0.68	0.65	0.70	0.73	0.65	0.63	0.71	0.77	1.00	0.78
0.61	0.71	0.74	0.77	0.79	0.76	0.79	0.71	0.63	0.47	0.73	0.78	1.00

Table C-15

Intercorrelations Among Abilities for Munitions Maintenance (461XX) Supervisors on Performance Quality Variability-Magnitude Estimation Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.82	0.70	0.58	0.53	0.48	0.48	0.28	0.46	0.34	0.54	0.17	0.55
0.82	1.00	0.88	0.61	0.62	0.59	0.65	0.31	0.46	0.59	0.56	0.41	0.74
0.70	0.88	1.00	0.55	0.54	0.54	0.62	0.22	0.34	0.61	0.61	0.32	0.65
0.58	0.61	0.55	1.00	0.57	0.54	0.57	0.78	0.47	0.43	0.49	0.38	0.68
0.53	0.62	0.54	0.57	1.00	0.94	0.39	0.53	0.37	0.65	0.63	0.46	0.58
0.48	0.59	0.54	0.54	0.94	1.00	0.94	0.52	0.27	0.76	0.56	0.40	0.53
0.48	0.65	0.62	0.57	0.89	0.94	1.00	0.47	0.25	0.78	0.65	0.34	0.55
0.28	0.31	0.22	0.78	0.53	0.52	0.47	1.00	0.30	0.37	0.47	0.56	0.66
0.46	0.46	0.34	0.47	0.37	0.27	0.25	0.30	1.00	0.21	0.50	-0.04	0.31
0.34	0.59	0.61	0.43	0.65	0.76	0.78	0.37	0.21	1.00	0.48	0.46	0.50
0.54	0.56	0.61	0.49	0.63	0.56	0.65	0.47	0.50	0.48	1.00	0.23	0.50
0.17	0.41	0.32	0.38	0.46	0.40	0.34	0.56	-0.04	0.46	0.23	1.00	0.76
0.55	0.74	0.65	0.68	0.58	0.53	0.55	0.66	0.31	0.50	0.50	0.76	1.00

Table C-16

Intercorrelations Among Abilities for Munitions Maintenance (461XX) Subordinates on Performance Quality Variability-Magnitude Estimation Scale

FD	MD	CP	RC	VM	VSA	PM	AD	AM	CLP	DP	DA	KM
1.00	0.62	0.47	0.15	0.63	0.70	0.70	0.02	0.21	0.65	0.18	0.11	0.11
0.62	1.00	0.59	0.54	0.84	0.79	0.83	0.38	0.62	0.53	0.36	0.25	0.46
0.47	0.59	1.00	0.56	0.60	0.57	0.44	0.27	0.40	0.52	0.47	0.08	0.21
0.15	0.54	0.56	1.00	0.60	0.51	0.50	0.63	0.76	0.43	0.43	0.18	0.46
0.63	0.84	0.60	0.60	1.00	0.82	0.88	0.41	0.64	0.66	0.45	0.09	0.40
0.70	0.79	0.57	0.51	0.82	1.00	0.89	0.47	0.58	0.67	0.56	0.33	0.25
0.70	0.83	0.44	0.50	0.88	0.89	1.00	0.40	0.58	0.73	0.36	0.26	0.38
0.02	0.38	0.27	0.63	0.41	0.47	0.40	1.00	0.84	0.22	0.68	0.41	0.31
0.21	0.62	0.40	0.76	0.64	0.58	0.58	0.84	1.00	0.39	0.62	0.16	0.34
0.65	0.53	0.52	0.43	0.66	0.67	0.73	0.22	0.39	1.00	0.31	-0.03	-0.00
0.18	0.36	0.47	0.43	0.45	0.56	0.36	0.68	0.62	0.31	1.00	0.49	0.09
0.11	0.25	0.08	0.18	0.09	0.33	0.25	0.41	0.16	-0.08	0.49	1.00	0.36
0.11	0.46	0.21	0.46	0.40	0.25	0.38	0.31	0.34	-0.00	0.09	0.36	1.00

APPENDIX D

Frequency Distributions of Amount Ratings for 13 Perceptual/Psychomotor Abilities in 35 AFSCs

MECHANICAL

Munitions Maintenance

Scale	FD	MD	CP	RC	VH	VS SA	PM	AD	AM	CP	DP	DA	KM	SUM
6.00-6.99	-	-	2	2	-	-	-	-	-	-	-	-	-	4
5.00-5.99	1	6	1	1	-	3	-	-	-	-	-	-	-	12
4.00-4.99	9	13	4	-	6	7	2	2	-	1	3	-	-	47
3.00-3.99	15	5	8	5	20	12	20	3	-	5	3	1	-	97
2.00-2.99	17	9	10	6	25	21	19	4	7	23	2	17	-	160
1.00-1.99	18	27	34	36	9	17	19	11	15	23	18	40	8	275
0.00-0.99	-	-	1	10	-	-	-	40	38	8	34	2	52	185

Weapons Mechanic

Scale	FD	MD	CP	RC	VH	VS SA	PM	AD	AM	CP	DP	DA	KM	SUM
5.00-5.99	2	1	-	-	2	3	3	-	-	-	-	-	-	11
4.00-4.99	17	11	2	1	36	25	36	-	-	-	2	-	-	128
3.00-3.99	23	29	26	12	10	19	9	1	-	3	6	-	13	152
2.00-2.99	5	7	17	31	10	8	7	7	2	25	30	24	23	196
1.00-1.99	12	12	14	15	2	4	7	29	32	31	20	32	17	227
0.00-0.99	1	-	1	1	-	-	-	23	26	1	2	4	7	66

Air Passenger and Air Cargo Specialist

Scale	FD	MD	CP	RC	VH	VS SA	PM	AD	AM	CP	DP	DA	KM	SUM
5.00-5.99	2	-	3	-	-	2	-	-	-	-	-	-	-	7
4.00-4.99	10	22	12	13	9	6	7	5	-	11	1	1	-	97
3.00-3.99	24	8	9	5	34	28	21	9	4	16	16	10	1	185
2.00-2.99	22	15	17	11	16	16	30	15	21	8	10	36	22	239
1.00-1.99	2	15	19	30	1	7	2	29	24	20	29	13	35	226
0.00-0.99	-	-	-	1	-	1	-	2	11	5	4	-	2	26

Aircraft Loadmaster

Scale	FD	MD	CP	RC	VH	VS SA	PM	AD	AM	CP	DP	DA	KM	SUM
4.00-4.99	7	6	-	-	13	1	16	-	-	2	-	-	-	45
3.00-3.99	18	17	2	-	27	30	24	-	-	5	-	8	-	131
2.00-2.99	25	25	17	10	14	20	16	10	5	9	5	16	1	173
1.00-1.99	10	12	38	46	6	9	4	27	33	38	38	36	51	348
0.00-0.99	-	-	3	4	-	-	-	23	22	6	17	-	8	83

LGM 25 Missile Mechanic

Scale	FD	MD	CP	RC	VH	VS SA	PM	AD	AM	CP	DP	DA	KM	SUM
5.00-5.99	-	-	1	1	-	1	-	-	-	-	-	-	-	3
4.00-4.99	8	13	1	1	-	9	7	-	-	-	1	-	-	40
3.00-3.99	20	22	14	-	19	19	27	-	-	-	1	1	7	130
2.00-2.99	25	14	17	11	33	11	18	2	-	7	10	7	20	175
1.00-1.99	6	10	19	36	8	19	8	10	11	8	40	47	17	249
0.00-0.99	1	1	8	11	-	1	-	48	49	35	8	5	16	183

Vehicle Operator/Dispatcher

Scale	FD	MD	CP	RC	VH	VS SA	PM	AD	AM	CP	DP	DA	KM	SUM
5.00-5.99	1	2	8	7	-	-	-	-	-	-	6	-	-	24
4.00-4.99	12	14	7	6	11	4	9	6	-	2	9	8	2	90
3.00-3.99	25	12	2	3	26	11	21	10	9	23	-	6	8	156
2.00-2.99	21	18	17	9	21	38	23	8	12	18	8	32	7	232
1.00-1.99	1	14	26	35	2	6	7	33	39	17	36	14	43	273
0.00-0.99	-	-	-	-	-	1	-	3	-	-	1	-	-	5

Fuels Specialist

Scale	FD	MD	CP	RC	VH	VS SA	PM	AD	AM	CP	DP	DA	KM	SUM
6.00-6.99	1	-	-	-	-	-	-	-	-	-	-	-	-	1
5.00-5.99	2	4	1	1	1	2	-	-	-	-	-	-	-	11
4.00-4.99	15	12	11	-	26	15	13	-	-	[illegible]	1	-	-	96
3.00-3.99	17	13	10	15	25	24	25	11	-	[illegible]	-	9	-	158
2.00-2.99	17	17	12	11	8	15	17	6	11	[illegible]	11	20	3	164
1.00-1.99	8	14	18	14	-	4	5	7	11	16	21	30	33	181
0.00-0.99	-	-	8	19	-	-	-	36	38	16	27	1	24	169

Carpentry and Masonry Specialist

Scale	FD	MD	CP	RC	VH	VS SA	PM	AD	AM	CP	DP	DA	KM	SUM
5.00-5.99	1	4	-	-	-	-	-	-	-	-	-	-	-	5
4.00-4.99	12	15	-	-	5	1	5	-	-	-	-	-	-	38
3.00-3.99	13	8	3	3	19	18	17	-	-	4	-	-	-	85
2.00-2.99	19	23	20	22	23	27	16	-	-	6	14	13	12	195
1.00-1.99	15	10	27	22	13	14	22	24	4	35	25	46	41	298
0.00-0.99	-	-	10	13	-	-	-	36	56	15	21	1	7	159

ADMINISTRATIVE

Procurement Specialist

Scale	FD	MD	CP	RC	VH	VS SA	PM	AD	AM	CP	DP	DA	KM	SUM
4.00-4.99	-	-	-	-	4	-	-	-	-	7	-	-	-	11
3.00-3.99	3	-	-	-	24	-	-	-	-	25	-	-	-	52
2.00-2.99	16	12	-	-	28	25	3	-	-	22	-	7	-	113
1.00-1.99	40	48	1	-	3	33	54	-	-	6	-	51	-	236
0.00-0.99	1	-	59	60	1	2	3	60	60	-	60	2	60	368

Chapel Management

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CF	DF	DA	KM	SUM
6.00-6.99	1	-	-	-	-	-	-	-	-	-	-	-	-	1
5.00-5.99	8	-	-	-	-	-	-	-	-	-	-	-	-	8
4.00-4.99	7	-	-	-	3	1	3	-	-	1	-	-	-	15
3.00-3.99	9	10	1	-	17	6	14	-	-	6	-	-	-	63
2.00-2.99	24	29	5	1	26	24	9	2	1	21	-	-	-	142
1.00-1.99	11	21	40	5	14	28	32	3	4	15	11	34	-	218
0.00-0.99	-	-	14	54	-	1	2	55	55	17	49	26	60	333

Legal Services

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CF	DF	DA	KM	SUM
6.00-6.99	7	-	-	-	-	-	-	-	-	-	-	-	-	7
5.00-5.99	13	-	-	-	-	-	-	-	-	-	-	-	-	13
4.00-4.99	7	2	-	-	2	-	-	-	-	16	-	1	-	28
3.00-3.99	8	19	3	-	23	-	1	1	-	20	-	-	-	75
2.00-2.99	13	22	16	1	25	25	22	1	1	17	-	1	-	144
1.00-1.99	10	16	27	8	8	28	33	3	4	6	-	46	8	197
0.00-0.99	2	1	14	51	2	7	4	55	55	1	60	12	52	316

Radio Operator

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CF	DF	DA	KM	SUM
6.00-6.99	-	-	-	-	-	-	1	2	-	-	-	-	-	3
5.00-5.99	-	-	5	-	3	2	4	9	4	3	2	4	-	36
4.00-4.99	6	7	6	-	4	6	14	10	7	3	1	1	2	67
3.00-3.99	11	14	17	-	13	25	17	10	13	12	3	8	13	156
2.00-2.99	24	18	11	8	26	16	16	11	17	17	12	31	34	241
1.00-1.99	16	16	14	39	14	11	8	14	17	24	37	16	11	237
0.00-0.99	3	5	7	13	-	-	-	4	2	1	5	-	-	40

Personnel

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CF	DF	DA	KM	SUM
6.00-6.99	2	-	-	-	-	-	-	-	-	-	-	-	-	2
5.00-5.99	4	-	-	-	-	-	-	-	-	2	-	-	-	6
4.00-4.99	14	-	-	-	15	8	-	-	-	21	-	-	-	58
3.00-3.99	14	5	-	-	31	31	13	-	-	29	-	-	-	123
2.00-2.99	23	45	14	1	14	20	46	-	-	7	-	-	-	170
1.00-1.99	3	10	41	43	-	1	1	1	-	1	60	54	-	215
0.00-0.99	-	-	5	16	-	-	-	59	60	-	-	6	60	206

Air Traffic Control Operator Technician

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CF	DF	DA	KM	SUM
6.00-6.99	-	-	-	-	-	-	-	-	-	-	-	3	-	3
5.00-5.99	1	-	1	-	6	1	3	-	-	-	4	13	-	29
4.00-4.99	3	1	-	-	13	9	18	1	-	1	10	13	-	69
3.00-3.99	10	9	5	5	25	20	19	10	1	4	10	8	-	126
2.00-2.99	8	7	5	24	11	21	10	23	18	16	8	12	8	171
1.00-1.99	36	30	40	30	5	8	10	22	25	33	24	11	38	312
0.00-0.99	2	13	9	1	-	1	-	4	16	6	4	-	14	70

Airman Administration

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CF	DF	DA	KM	SUM
5.00-5.99	3	-	-	-	-	-	-	-	-	-	-	-	-	3
4.00-4.99	7	3	-	-	2	-	-	-	-	-	-	-	-	12
3.00-3.99	23	18	6	1	8	7	4	-	-	15	8	-	-	90
2.00-2.99	23	30	14	6	36	28	29	1	-	20	7	6	-	200
1.00-1.99	4	9	39	46	14	25	27	1	2	5	11	38	9	230
0.00-0.99	-	-	1	7	-	-	-	58	58	20	34	16	51	245

Supply Services

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CF	DF	DA	KM	SUM
4.00-4.99	4	3	-	-	-	-	-	-	-	-	-	-	-	7
3.00-3.99	35	19	-	1	19	13	19	-	-	4	-	4	-	114
2.00-2.99	19	32	8	18	40	44	34	-	-	32	2	31	1	261
1.00-1.99	2	6	50	38	1	3	-	37	28	24	48	25	54	316
0.00-0.99	-	-	2	3	-	-	7	23	32	-	10	-	5	82

Airport Air Operations

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CF	DF	DA	KM	SUM
5.00-5.99	-	-	-	-	-	-	-	-	-	1	-	-	-	1
4.00-4.99	2	1	-	-	-	-	-	-	-	8	-	-	-	11
3.00-3.99	6	6	-	-	-	2	-	-	-	11	-	2	-	27
2.00-2.99	27	20	2	-	22	22	3	-	-	28	-	7	-	131
1.00-1.99	22	27	23	-	30	26	32	16	50	12	1	23	-	262
0.00-0.99	3	6	35	60	8	10	25	44	10	-	59	28	60	348

GENERAL

Intelligence Operations and Imagery Interpretation

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AM	CF	DF	DA	KM	SUM
6.00-6.99	1	-	-	-	-	-	-	-	-	-	-	-	-	1
5.00-5.99	1	-	-	-	1	-	-	-	-	-	-	-	-	2
4.00-4.99	4	3	-	-	7	5	3	-	-	-	-	-	-	22
3.00-3.99	17	16	1	-	19	12	14	-	-	4		-	-	83
2.00-2.99	18	12	1	-	22	24	16	-	-	17	-	1	-	111
1.00-1.99	15	21	26	8	11	17	21	2	1	29	11	35	1	198
0.00-0.99	4	8	32	52	-	2	6	58	59	10	49	24	59	363

Weather Forecaster

Scale	FD	MD	CP	RC	VM	VS AA	FM	AD	AH	CP	DF	DA	KN	SUM
6.00-6.99	-	-	-	-	-	-	-	-	-	1	-	-	-	1
5.00-5.99	1	-	-	-	9	13	-	-	-	9	-	6	-	38
4.00-4.99	4	1	-	-	26	15	16	-	-	38	-	23	-	123
3.00-3.99	26	11	1	-	21	24	26	-	-	11	1	18	-	139
2.00-2.99	17	22	3	1	4	8	14	-	-	-	6	12	-	87
1.00-1.99	12	23	29	17	-	-	4	8	7	1	39	1	5	146
0.00-0.99	-	3	27	42	-	-	-	52	53	-	14	-	55	246

Information Specialist

Scale	FD	MD	CP	RC	VM	VS AA	FM	AD	AH	CP	DF	DA	KN	SUM
5.00-5.99	6	1	-	-	3	1	-	-	-	2	-	-	-	13
4.00-4.99	5	-	1	-	11	4	-	1	-	13	1	1	-	37
3.00-3.99	12	14	1	1	16	10	5	-	1	14	-	-	-	74
2.00-2.99	15	23	-	1	-	27	23	-	-	25	1	9	1	125
1.00-1.99	20	18	15	8	6	18	32	15	13	6	3	46	7	207
0.00-0.99	2	4	43	50	24	-	-	44	46	-	55	4	52	324

Inventory Management, Material Facilities and Supply Systems

Scale	FD	MD	CP	RC	VM	VS AA	FM	AD	AH	CP	DF	DA	KN	SUM
6.00-6.99	1	-	-	-	-	-	-	-	-	-	-	-	-	1
5.00-5.99	1	-	-	-	-	-	-	-	-	-	-	-	-	1
4.00-4.99	-	2	-	-	-	-	-	-	-	8	-	-	-	10
3.00-3.99	10	6	3	-	10	13	13	-	-	31	-	-	-	86
2.00-2.99	40	18	8	4	35	20	37	1	-	13	3	-	11	190
1.00-1.99	8	34	20	13	15	27	8	6	1	3	45	1	49	230
0.00-0.99	-	-	29	43	-	-	2	53	59	5	12	59	-	262

Medical Services

Scale	FD	MD	CP	RC	VM	VS AA	FM	AD	AH	CP	DF	DA	KN	SUM
5.00-5.99	1	-	-	-	-	-	-	-	-	-	-	-	-	1
4.00-4.99	7	14	1	-	12	3	5	-	-	1	-	4	-	47
3.00-3.99	18	16	7	1	18	10	16	4	4	11	-	1	-	106
2.00-2.99	24	22	16	6	26	24	27	3	2	18	1	6	5	180
1.00-1.99	10	8	32	40	4	21	11	15	14	26	37	44	32	294
0.00-0.99	-	-	4	13	-	2	1	38	40	4	22	5	23	152

Dental and Preventive Dentistry Technician

Scale	FD	MD	CP	RC	VM	VS AA	FM	AD	AH	CP	DF	DA	KN	SUM
6.00-6.99	2	-	-	-	-	-	-	-	-	-	-	-	-	2
5.00-5.99	4	1	-	-	-	-	-	-	-	-	-	-	-	5
4.00-4.99	7	14	-	-	4	5	3	-	-	1	-	-	-	34
3.00-3.99	22	21	7	1	22	14	15	1	-	6	-	-	-	109
2.00-2.99	17	17	13	3	23	24	26	2	1	6	10	3	-	145
1.00-1.99	8	7	29	34	11	16	16	7	7	14	19	22	22	212
0.00-0.99	-	-	11	22	-	1	-	50	52	33	31	35	38	273

Fire Protection

Scale	FD	MD	CP	RC	VM	VS AA	FM	AD	AH	CP	DF	DA	KN	SUM
5.00-5.99	-	-	-	-	-	-	-	-	-	-	-	1	-	1
4.00-4.99	13	1	-	1	-	-	-	2	-	1	-	2	-	20
3.00-3.99	20	9	8	5	7	4	8	5	1	2	10	9	-	88
2.00-2.99	12	32	22	19	37	33	32	16	9	6	8	19	23	268
1.00-1.99	13	18	29	35	16	23	20	22	33	43	33	29	37	351
0.00-0.99	2	-	1	-	-	-	-	15	17	8	9	-	-	52

Graphics

Scale	FD	MD	CP	RC	VM	VS AA	FM	AD	AH	CP	DF	DA	KN	SUM
6.00-6.99	6	1	-	-	-	-	-	-	-	-	-	-	-	7
5.00-5.99	11	11	-	-	6	-	-	-	-	-	-	-	-	28
4.00-4.99	15	17	-	-	19	3	-	-	-	5	-	-	-	59
3.00-3.99	8	11	1	-	14	14	16	-	-	18	6	-	-	88
2.00-2.99	12	12	10	-	15	28	29	-	-	15	14	4	-	139
1.00-1.99	8	8	29	28	6	13	13	-	-	13	21	35	27	201
0.00-0.99	-	-	20	32	-	2	2	60	60	9	19	21	33	258

Still Photographic

Scale	FD	MD	CP	RC	VM	VS AA	FM	AD	AH	CP	DF	DA	KN	SUM
5.00-5.99	4	5	3	-	-	-	-	-	-	-	-	-	-	12
4.00-4.99	9	10	5	1	21	8	9	-	-	-	-	-	1	64
3.00-3.99	19	16	12	1	25	22	18	-	-	4	1	-	1	119
2.00-2.99	14	15	14	12	13	22	31	5	-	20	8	6	7	167
1.00-1.99	14	13	23	34	1	8	2	17	10	27	41	51	33	274
0.00-0.99	-	1	3	12	-	-	-	38	50	9	10	3	18	144

ELECTRONICS

Missile Electronic Equipment Specialist

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AN	CP	DP	DA	KN	SUM
5.00-5.99	-	-	1	1	-	-	-	-	-	-	-	-	-	2
4.00-4.99	1	4	1	1	1	5	1	3	-	3	1	-	-	21
3.00-3.99	18	17	8	-	18	16	14	3	5	3	1	1	-	104
2.00-2.99	31	26	13	5	22	22	31	10	4	8	3	1	3	179
1.00-1.99	10	13	36	42	19	13	13	7	11	30	22	13	11	240
0.00-0.99	-	-	1	11	-	4	1	37	40	16	33	45	46	234

Missile Facilities

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AN	CP	DP	DA	KN	SUM
5.00-5.99	6	-	1	-	-	2	5	-	-	-	-	-	-	14
4.00-4.99	16	15	12	-	6	9	18	1	-	-	-	-	-	77
3.00-3.99	17	19	10	-	22	25	16	3	-	4	-	-	-	116
2.00-2.99	15	14	12	2	21	14	10	18	4	3	3	16	17	149
1.00-1.99	6	12	12	21	10	9	10	14	24	34	45	30	20	247
0.00-0.99	-	-	13	37	1	1	1	24	32	19	12	14	23	177

Aircraft Electrical Systems Specialist

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AN	CP	DP	DA	KN	SUM
5.00-5.99	6	2	-	-	1	5	5	-	-	-	-	-	-	19
4.00-4.99	8	11	3	-	19	21	22	-	-	-	-	-	7	91
3.00-3.99	20	18	16	-	29	26	23	1	-	13	-	-	5	151
2.00-2.99	19	19	23	8	11	6	9	6	4	28	15	3	15	166
1.00-1.99	7	9	17	44	-	2	1	46	44	19	39	55	29	312
0.00-0.99	-	1	1	8	-	-	-	7	12	-	6	2	4	41

Avionic Instrument Systems Specialist

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AN	CP	DP	DA	KN	SUM
6.00-6.99	2	1	-	-	1	-	-	-	-	-	-	-	-	4
5.00-5.99	5	9	6	-	2	10	24	-	-	-	-	-	-	56
4.00-4.99	30	25	18	1	22	25	16	-	-	3	-	-	5	145
3.00-3.99	15	16	21	7	28	16	12	-	-	31	3	3	21	173
2.00-2.99	2	3	7	32	4	6	4	3	1	15	28	36	19	160
1.00-1.99	6	5	4	13	3	3	4	45	47	8	25	19	8	190
0.00-0.99	-	1	4	7	-	-	-	12	12	3	4	2	7	52

Ground Radio Equipment Repair

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AN	CP	DP	DA	KN	SUM
6.00-6.99	1	1	-	-	-	-	-	-	-	-	-	-	-	2
5.00-5.99	9	12	6	-	6	2	1	-	-	-	1	-	-	37
4.00-4.99	13	11	8	1	21	19	14	5	1	2	-	1	1	97
3.00-3.99	7	13	16	4	14	15	25	8	8	5	-	1	9	125
2.00-2.99	13	7	11	15	17	18	13	6	8	18	3	37	17	183
1.00-1.99	17	16	19	32	2	6	7	28	21	35	55	21	28	287
0.00-0.99	-	-	-	8	-	-	-	13	22	-	1	-	5	49

Electrician

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AN	CP	DP	DA	KN	SUM
5.00-5.99	2	1	-	-	-	-	-	-	-	-	-	-	-	3
4.00-4.99	16	26	-	-	23	2	10	2	-	-	-	-	-	79
3.00-3.99	28	23	7	-	29	28	32	-	-	1	-	-	-	148
2.00-2.99	12	10	40	12	4	26	14	40	2	2	19	1	6	188
1.00-1.99	2	-	13	46	4	4	4	18	11	35	37	35	51	260
0.00-0.99	-	-	-	2	-	-	-	-	47	22	4	24	3	102

Electricial Power Production

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AN	CP	DP	DA	KN	SUM
5.00-5.99	-	-	1	-	1	-	-	-	-	-	-	-	-	2
4.00-4.99	7	10	6	1	8	5	14	2	-	-	-	-	-	53
3.00-3.99	28	19	7	3	26	22	20	2	-	6	-	2	-	135
2.00-2.99	15	22	24	4	21	14	14	9	7	4	1	3	11	149
1.00-1.99	10	8	15	24	4	19	12	13	13	12	15	16	23	184
0.00-0.99	-	1	7	28	-	-	-	34	40	38	44	39	26	257

Aircraft Fuel Systems Mechanic

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AN	CP	DP	DA	KN	SUM
5.00-5.99	3	3	-	-	-	-	1	-	-	-	-	-	-	7
4.00-4.99	11	6	-	-	14	4	8	-	-	1	-	-	3	47
3.00-3.99	17	17	2	-	26	15	29	-	-	1	-	-	3	110
2.00-2.99	24	24	25	3	16	29	16	1	1	12	5	-	13	169
1.00-1.99	5	10	37	[illegible]	4	12	6	21	14	16	43	47	29	279
0.00-0.99	-	-	[illegible]	17	-	-	-	38	45	30	12	13	12	168

Jet Engine Mechanic

Scale	FD	MD	CP	RC	VM	VS &A	PM	AD	AN	CP	DP	DA	KN	SUM
6.00-6.99	-	1	-	-	-	1	-	-	-	-	-	-	-	2
5.00-5.99	4	6	-	-	3	8	8	-	-	-	-	-	-	29
4.00-4.99	8	5	3	-	18	14	17	1	-	-	-	-	1	70
3.00-3.99	16	7	13	-	13	11	11	4	3	7	1	2	4	92
2.00-2.99	24	20	17	18	24	12	9	5	3	15	10	10	13	180
1.00-1.99	9	18	21	25	2	14	15	18	16	28	26	43	21	255
0.00-0.99	-	-	6	17	-	-	-	32	33	7	23	5	21	144

APPENDIX E

Frequency Distributions of Performance Quality Variability Ratings for 13 Perceptual/Psychomotor Abilities in 35 AFSCs

Scale	FD	MD	CP	RC	VM	VS SA	FM	AD	AM	CP	DP	DA	EM	SUM
MECHANICAL														
Munitions Maintenance														
4.00-4.99	-	1	1	-	-	-	-	-	-	-	-	-	-	2
3.00-3.99	5	12	3	2	2	-	-	-	-	-	3	-	-	27
2.00-2.99	21	14	5	1	36	21	26	5	-	15	3	3	-	150
1.00-1.99	34	33	42	23	22	39	33	11	20	32	12	46	11	358
0.00-0.99	-	-	9	34	-	-	1	44	40	13	42	11	49	243
Weapons Mechanic														
3.00-3.99	13	16	2	2	28	27	26	-	-	-	1	-	-	117
2.00-2.99	28	26	38	34	19	23	22	1	-	6	31	12	18	258
1.00-1.99	15	17	19	23	13	9	12	40	39	51	23	46	29	338
0.00-0.99	2	1	1	1	-	1	-	19	21	3	3	2	13	67
Air Passenger and Air Cargo Specialist														
5.00-5.99	-	-	-	-	-	1	-	-	-	-	-	-	-	1
4.00-4.99	2	1	3	-	4	10	-	-	-	1	-	-	-	21
3.00-3.99	9	13	17	19	28	24	6	6	7	11	3	4	-	147
2.00-2.99	44	32	17	26	25	22	37	20	25	23	31	30	32	364
1.00-1.99	5	14	23	14	3	3	17	31	27	25	26	26	28	242
0.00-0.99	-	-	-	1	-	-	-	3	1	-	-	-	-	5
Aircraft Loadmaster														
3.00-3.99	1	-	-	-	6	3	7	-	-	1	-	-	-	18
2.00-2.99	45	47	26	9	43	42	36	-	-	16	3	17	-	284
1.00-1.99	14	13	34	51	11	15	17	55	43	40	47	39	36	415
0.00-0.99	-	-	-	-	-	-	-	5	17	3	10	4	24	63
LGM 25 Missile Mechanic														
3.00-3.99	-	9	3	1	3	1	4	-	-	-	2	-	1	24
2.00-2.99	33	33	18	6	35	27	34	1	-	3	5	2	20	217
1.00-1.99	26	17	32	47	22	32	22	24	23	24	43	42	31	385
0.00-0.99	1	1	7	6	-	-	-	35	37	33	10	16	8	154
Vehicle Operator/Dispatcher														
4.00-4.99	2	2	10	7	1	1	1	-	-	-	6	-	-	28
3.00-3.99	16	13	6	8	18	8	17	8	7	11	10	11	1	134
2.00-2.99	38	34	22	8	32	35	37	12	11	35	3	44	18	329
1.00-1.99	4	11	22	36	9	16	5	33	37	16	43	5	40	275
0.00-0.99	-	-	-	1	-	-	-	7	5	-	-	-	1	14
Fuels Specialist														
3.00-3.99	2	4	3	-	10	3	3	-	-	1	-	1	-	27
2.00-2.99	26	20	20	17	36	29	27	9	1	15	4	9	1	214
1.00-1.99	30	28	31	26	14	25	28	15	28	28	25	48	29	355
0.00-0.99	2	8	6	17	-	3	2	36	31	16	31	2	30	184
Carpentry and Masonry Specialist														
4.00-4.99	5	17	-	-	1	-	-	-	-	-	-	-	-	23
3.00-3.99	23	15	5	-	26	18	19	-	-	2	-	-	-	108
2.00-2.99	28	25	37	30	30	29	32	-	-	18	2	17	12	260
1.00-1.99	4	3	18	30	3	13	9	41	25	35	36	35	10	262
0.00-0.99	-	-	-	-	-	-	-	19	35	5	22	8	38	127
ADMINISTRATIVE														
Procurement Specialist														
3.00-3.99	-	-	-	-	8	-	-	-	-	9	-	-	-	17
2.00-2.99	4	-	-	-	43	4	-	-	-	45	-	-	-	96
1.00-1.99	53	54	4	-	9	56	32	-	-	6	-	59	-	273
0.00-0.99	3	6	56	60	-	-	28	60	60	-	60	1	60	394
Chapel Management														
4.00-4.99	1	-	-	-	-	-	-	-	-	-	-	-	-	1
3.00-3.99	10	-	-	-	4	-	2	-	-	3	-	-	-	19
2.00-2.99	18	15	2	-	36	11	20	1	-	14	-	2	-	119
1.00-1.99	30	45	42	7	20	48	36	2	2	26	5	53	-	316
0.00-0.99	1	-	16	53	-	1	2	57	58	17	55	5	60	325

Scale	FD	ND	CP	RC	VM	VS 44	PM	AD	AN	CP	DP	DA	EM	SUM
Legal Services														
4.00-4.99	6	-	-	-	-	-	-	-	-	-	-	-	-	6
3.00-3.99	21	4	-	-	13	-	-	-	-	17	-	1	-	56
2.00-2.99	15	29	3	-	35	12	11	-	1	30	-	-	-	136
1.00-1.99	18	27	45	3	12	45	42	4	3	11	-	19	3	232
0.00-0.99	-	-	12	57	-	3	7	56	56	2	60	40	57	350
Radio Operator														
4.00-4.99	-	2	-	-	-	-	-	1	-	-	-	-	-	3
3.00-3.99	6	9	5	-	2	5	3	3	4	2	-	2	-	41
2.00-2.99	19	21	26	5	20	19	24	13	7	17	2	8	6	187
1.00-1.99	32	26	26	44	32	31	31	29	12	38	41	44	51	435
0.00-0.99	3	4	3	11	6	5	2	14	37	3	17	6	3	114
Personnel														
4.00-4.99	1	-	-	-	2	-	-	-	-	4	-	-	-	7
3.00-3.99	10	-	-	-	12	11	-	-	-	27	-	-	-	60
2.00-2.99	42	15	3	-	44	47	22	-	-	29	-	-	-	202
1.00-1.99	7	45	56	27	2	2	38	1	-	-	-	42	-	220
0.00-0.99	-	-	1	33	-	-	-	59	60	-	60	18	60	291
Air Traffic Control Operator Technician														
4.00-4.99	-	-	-	-	10	1	1	-	-	-	2	9	-	23
3.00-3.99	1	1	1	-	14	21	17	5	-	4	13	21	-	98
2.00-2.99	11	11	5	7	24	23	26	25	17	5	15	17	1	187
1.00-1.99	48	41	51	52	12	14	16	20	31	45	25	12	31	398
0.00-0.99	-	7	3	1	-	1	-	10	12	6	5	1	28	74
Airman Administration														
4.00-4.99	2	-	-	-	-	-	-	-	-	-	-	-	-	2
3.00-3.99	5	2	-	-	4	-	-	-	-	4	-	-	-	15
2.00-2.99	9	12	3	-	26	20	15	-	-	38	-	1	-	122
1.00-1.99	43	46	56	49	30	38	45	1	-	20	5	42	3	378
0.00-0.99	1	-	1	11	-	2	-	59	60	-	55	17	57	263
Supply Services														
3.00-3.99	4	6	-	-	6	8	8	-	-	4	-	-	-	36
2.00-2.99	48	40	3	8	45	49	41	-	-	35	-	43	2	313
1.00-1.99	8	13	52	47	9	3	11	35	43	21	38	17	55	353
0.00-0.99	-	1	5	5	-	-	-	25	17	-	22	-	3	78
Airport Air Operations														
5.00-5.99	-	-	-	-	-	-	-	-	-	1	-	-	-	1
4.00-4.99	-	-	-	-	-	-	-	-	-	8	-	-	-	8
3.00-3.99	1	-	-	-	-	-	-	-	-	11	-	2	-	14
2.00-2.99	7	4	-	-	6	6	-	-	-	28	-	7	-	56
1.00-1.99	38	38	20	2	48	50	39	16	10	12	1	23	-	297
0.00-0.99	14	18	40	58	6	6	21	44	50	-	59	28	60	404
GENERAL														
Intelligence Operations and Imagery Interpretation														
4.00-4.99	1	-	-	-	-	-	-	-	-	-	-	-	-	1
3.00-3.99	4	3	-	-	11	1	1	-	-	4	-	-	-	24
2.00-2.99	12	8	-	-	18	16	14	-	-	17	-	1	-	84
1.00-1.99	41	41	4	2	30	28	31	2	1	29	11	35	1	256
0.00-0.99	2	8	56	58	3	15	14	58	59	10	49	24	59	415
Weather Forecaster														
5.00-5.99	-	-	-	-	1	-	-	-	-	-	-	2	-	3
4.00-4.99	-	-	-	-	23	15	1	-	-	20	1	17	-	7
3.00-3.99	6	-	-	-	27	30	25	-	-	29	-	27	-	[illegible]
2.00-2.99	35	28	-	2	9	15	31	-	-	9	-	16	-	[illegible]
1.00-1.99	19	32	11	10	-	-	3	5	5	2	46	-	11	[illegible]
0.00-0.99	-	-	49	48	-	-	-	55	55	-	13	-	49	[illegible]
Information Specialist														
4.00-4.99	1	-	-	-	6	2	-	-	-	4	-	-	-	13
3.00-3.99	4	1	-	-	13	3	2	-	-	9	1	-	-	33
2.00-2.99	10	6	1	-	14	13	9	1	1	15	-	5	-	75
1.00-1.99	35	38	21	14	27	35	43	6	7	28	5	35	2	296
0.00-0.99	10	15	38	46	-	7	6	53	52	4	54	20	58	363

Scale	FD	MD	CP	RC	VN	VS &A	PM	AD	AM	CP	DP	DA	DM	SUM
Inventory Management, Material Facilities and Supply Systems														
4.00–4.99	-	-	-	-	-	-	-	-	-	8	-	-	-	8
3.00–3.99	2	3	-	-	-	-	-	-	-	31	-	-	-	36
2.00–2.99	20	15	4	-	3	10	14	1	-	13	1	3	-	84
1.00–1.99	38	42	18	8	25	50	44	6	1	3	1	45	1	282
0.00–0.99	-	-	38	52	32	-	2	53	59	5	58	12	59	370
Medical Services														
4.00–4.99	-	-	-	-	4	-	-	-	-	-	-	-	-	4
3.00–3.99	5	11	1	-	18	15	11	3	1	4	-	4	-	73
2.00–2.99	26	32	19	6	31	22	33	2	4	25	2	10	-	210
1.00–1.99	30	16	35	38	7	23	16	33	29	27	30	40	43	366
0.00–0.99	1	1	5	16	-	-	-	22	26	4	28	6	17	127
Dental and Preventive Dentistry Technician														
5.00–5.99	2	1	-	-	-	-	-	-	-	-	-	-	-	3
4.00–4.99	6	4	-	-	-	2	-	-	-	1	-	-	-	13
3.00–3.99	10	16	3	1	16	6	7	-	-	11	-	-	-	68
2.00–2.99	30	30	15	1	37	26	21	2	-	1	5	1	1	170
1.00–1.99	12	9	42	57	9	26	32	6	6	19	30	30	16	294
0.00–0.99	-	-	-	1	-	-	-	52	54	28	25	29	43	232
Fire Protection														
4.00–4.99	-	1	-	1	-	-	-	-	-	-	-	-	-	2
3.00–3.99	5	9	8	5	7	4	8	-	-	-	-	2	-	48
2.00–2.99	25	32	22	19	37	33	32	5	5	6	11	23	7	257
1.00–1.99	30	18	29	35	16	23	20	53	55	54	49	35	51	468
0.00–0.99	-	-	1	-	-	-	-	2	-	-	-	-	2	5
Graphics														
5.00–5.99	3	-	-	-	-	-	-	-	-	-	-	-	-	3
4.00–4.99	1	3	-	-	-	4	-	-	-	-	-	-	-	8
3.00–3.99	15	8	-	-	13	1	1	-	-	-	-	-	-	33
2.00–2.99	27	25	2	-	24	19	16	-	-	13	6	-	-	132
1.00–1.99	14	24	17	25	22	36	37	-	-	31	23	12	17	258
0.00–0.99	-	-	41	35	1	-	6	60	60	16	31	48	43	341
Still Photographic														
4.00–4.99	2	3	3	-	-	-	-	-	-	-	-	-	-	8
3.00–3.99	8	9	2	-	18	3	7	-	-	-	-	-	1	48
2.00–2.99	28	26	21	7	31	32	25	-	-	7	6	-	5	188
1.00–1.99	22	22	32	47	11	25	28	13	9	45	40	57	37	388
0.00–0.99	-	-	2	6	-	-	-	47	51	8	14	3	17	168
ELECTRONICS														
Missile Electronic Equipment Specialist														
3.00–3.99	4	2	1	1	1	1	-	1	-	2	1	-	-	16
2.00–2.99	27	23	14	3	23	22	18	4	2	5	-	1	2	144
1.00–1.99	29	35	45	53	36	37	42	24	27	46	17	14	43	448
0.00–0.99	-	-	-	3	-	-	-	31	31	7	42	45	15	174
Missile Facilities														
4.00–4.99	-	-	-	-	-	-	-	1	-	-	-	-	-	1
3.00–3.99	2	6	8	-	-	-	-	3	-	4	-	-	-	23
2.00–2.99	34	34	13	-	7	23	22	18	4	3	3	16	17	194
1.00–1.99	24	18	23	26	50	36	31	14	24	34	45	30	20	375
0.00–0.99	-	2	16	34	3	1	7	24	32	19	12	14	23	187
Aircraft Electrical Systems Specialist														
4.00–4.99	6	2	-	-	4	9	8	-	-	-	-	-	4	33
3.00–3.99	10	15	2	-	35	35	33	-	-	4	-	-	14	148
2.00–2.99	23	23	26	5	21	13	17	5	-	37	11	12	25	218
1.00–1.99	21	20	28	48	-	3	2	53	57	19	49	48	17	365
0.00–0.99	-	-	4	7	-	-	-	2	3	-	-	-	-	16
Avionic Instrument Systems Specialist														
5.00–5.99	1	-	-	-	-	-	-	-	-	-	-	-	-	1
4.00–4.99	3	2	2	-	7	7	3	-	-	1	-	-	-	25
3.00–3.99	21	15	6	-	26	27	26	-	-	10	-	2	12	145
2.00–2.99	26	33	27	15	23	21	21	-	1	32	3	42	29	273
1.00–1.99	8	8	20	33	4	5	9	33	41	15	54	16	14	260
0.00–0.99	1	2	5	12	-	-	1	27	18	2	3	-	5	76

Ground Radio Equipment Repair

Scale	ED	ND	CP	EC	TW	VS LA	PH	AD	AM	CP	DP	DA	KH	SUM
5.00-5.99	-	-	-	-	-	-	-	-	-	-	1	-	-	1
4.00-4.99	-	-	-	-	-	-	-	5	1	2	-	1	1	10
3.00-3.99	8	7	2	-	1	-	1	8	8	5	3	1	8	52
2.00-2.99	29	28	23	17	24	24	14	6	8	18	-	37	17	245
1.00-1.99	23	25	35	43	35	36	45	28	21	35	55	21	29	431
0.00-0.99	-	-	-	-	-	-	-	13	22	-	1	-	5	41

Electrician

Scale	ED	ND	CP	EC	TW	VS LA	PH	AD	AM	CP	DP	DA	KH	SUM
3.00-3.99	12	4	-	-	14	4	4	-	-	-	-	-	-	38
2.00-2.99	43	49	1	-	41	50	50	1	-	1	-	-	-	236
1.00-1.99	5	7	58	40	5	4	6	9	3	15	51	48	6	257
0.00-0.99	-	-	1	20	-	2	-	50	57	44	9	12	54	249

Electrical Power Production

Scale	ED	ND	CP	EC	TW	VS LA	PH	AD	AM	CP	DP	DA	KH	SUM
3.00-3.99	8	4	2	-	-	1	-	-	-	-	-	-	-	15
2.00-2.99	31	26	9	-	28	21	19	-	-	3	-	-	-	137
1.00-1.99	19	29	40	21	32	36	38	16	13	12	6	12	28	302
0.00-0.99	2	1	9	39	-	2	3	44	47	45	54	48	32	326

Aircraft Fuel Systems Mechanic

Scale	ED	ND	CP	EC	TW	VS LA	PH	AD	AM	CP	DP	DA	KH	SUM
3.00-3.99	7	5	-	-	2	1	5	-	-	1	-	-	4	25
2.00-2.99	21	27	7	-	43	34	38	-	-	5	-	-	5	180
1.00-1.99	32	28	52	53	15	25	17	11	16	48	43	54	44	438
0.00-0.99	-	-	1	7	-	-	-	49	44	6	17	6	7	137

Jet Engine Mechanic

Scale	ED	ND	CP	EC	TW	VS LA	PH	AD	AM	CP	DP	DA	KH	SUM
4.00-4.99	1	-	-	-	-	-	-	-	-	-	-	-	-	1
3.00-3.99	7	9	1	1	7	11	12	1	-	-	-	1	-	50
2.00-2.99	28	26	21	12	28	23	27	6	3	4	9	10	4	201
1.00-1.99	24	25	28	36	25	25	21	27	25	54	30	41	34	395
0.00-0.99	-	-	10	11	-	1	-	26	32	2	21	8	22	133

APPENDIX F

Letter Introducing Survey

DEPARTMENT OF THE AIR FORCE
AIR FORCE HUMAN RESOURCES LABORATORY (AFSC)
BROOKS AIR FORCE BASE, TEXAS 78235

REPLY TO ATTN OF: AFHRL/OR

SUBJECT: Administrative Support for Job Requirements Study

TO: Occupational Survey Control Officer

1. As a Headquarters USAF-approved project, this Laboratory conducts research on establishing job requirements in the enlisted specialties. An important part of this effort is the development of job survey instruments for use in determining minimum entry requirements into various AFSs. In connection with this research effort, the firm of Applied Psychological Services Inc., working under AF Contract F33615-78-C-0032, is required to gather job requirements data at a representative sample of Air Force installations.

2. We request permission for two (2) contractor personnel to visit your CBPO for purposes of administering a job requirements survey to selected samples of enlisted personnel. The contractor personnel will bring all necessary survey materials for group administration and will conduct the sessions under your supervision. Since the number of respondents is large and varies by installation, we would also request administrative support in bringing groups of personnel within your jurisdiction to a central testing location on a schedule that is compatible with your office. Rosters will be provided or, if preferred, we will supply individual address labels for use in contacting respondents through base distribution.

3. It is anticipated that most of the survey administration activity can be conducted within a week's time. (See survey schedule at Atch 1). Further instructions and administrative material for the project will be forwarded within the next two weeks. We appreciate your assistance in this effort.

1 Atch
Survey Schedule

Introductory letter forwarded to all Air Bases included in the sample.